Technical Manual

- 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.

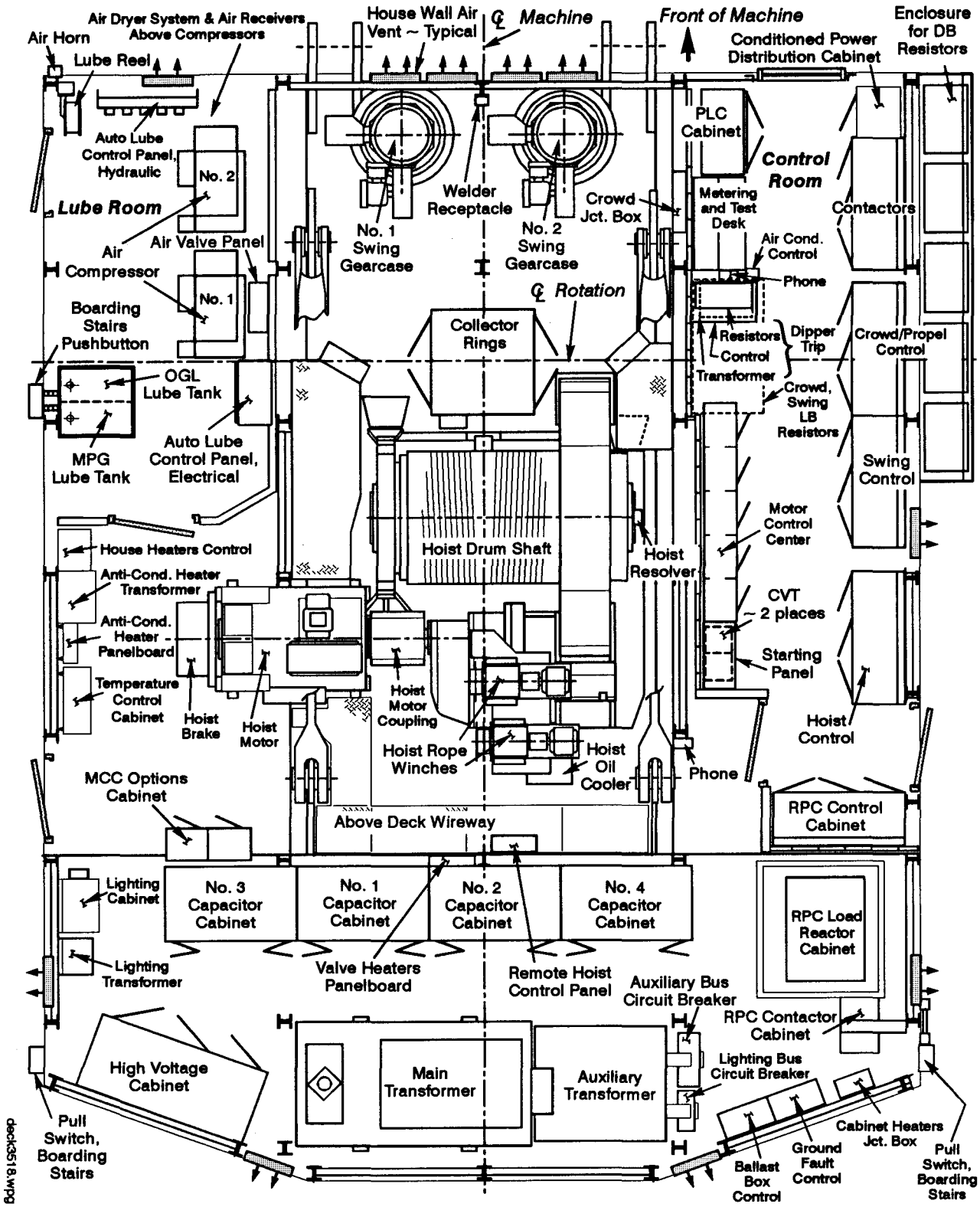
- Be sure to promptly reinstall safety devices, guards or shields after adjusting and/or servicing the machine.

- 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.



351M DECK PLAN

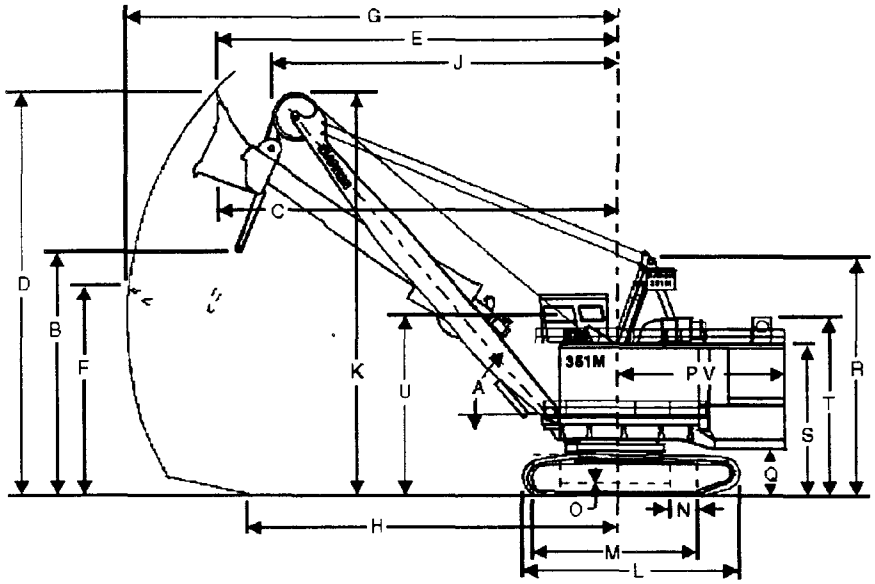
THE MARION POWER SHOVEL COMPANY

Model: 351M MINING SHOVEL

Description: Long Range - D.C.Static Power Conversion

Specification: 351M-LRCL-1B

No. 705040596



BOOM - HANDLE - DIPPER	Meters
Boom Length	22.9
Boom Sheave Diameter - Pitch Diameter	2.4
Dipper Handle Length	13.7
*Dipper Capacity, cu.m (63 Ton Payload)	64.3

*Based on Application.

+ WORKING RANGES (based on Std. Coal Dipper)

	With Limits
A - Boom Angle	53°
B - Dumping Height - Maximum	14.3
C - Dumping Radius @ Maximum Height	21.5
D - Cutting Height - Maximum	23.9
E - Cutting Radius @ Maximum Dump Height	22.9
F - Cutting Height @ Maximum Radius	12.1
G - Cutting Radius - Maximum	27.3
H - Radius of Clean-up	17.0
J - Clearance Radius - Outside Boom Point Sheave	18.7
K - Clearance Height - Over Boom Point Sheave	24.5

CRAWLER AND LOWER FRAME

L - Crawler Length	11.4
M - Crawler Width	11.6
N - Belt Width - Standard	2.0
Bearing Pressure, kgs/Sq. cm	3.4
Belt Width - Optional	2.6
Bearing Pressure - Optional, kgs/Sq.cm.	2.7
O - Clearance Under Lower Frame	0.8

UPPER FRAME	Meters
P - Clearance Radius - Rear End	10.1
Q - Clearance Under Frame	2.6
R - Clearance Height - Gantry	13.4
S - Clearance Height - Machinery House	8.2
T - Clearance Height - Filter House	10.0
U - Eye Level - Operator's Cab, Std.	9.6
V - Clearance Width - Machinery House	9.9
Hoist Drum - Pitch Diameter	1.8
Hoist Rope Diameter (Double Line), mm	63.5
Boom Support Rope Diameter (Quadruple), mm	88.9

ELECTRICAL EQUIPMENT	Cont. @475V	Peak
Hoist Motor, 824X Frame, Total kw.	970	1596
Swing Motors, Two, 816 Frame, Total kw	746	925
Propel Motors, Two, 814 Frame, Total kw	560	813
Crowd Motors, Two, 812 Frame, Total kw	380	552
Excavator D.C. Static Power Conversion		
Swing Speed, rpm.		2.6
Travel Speed, kph.		1.2

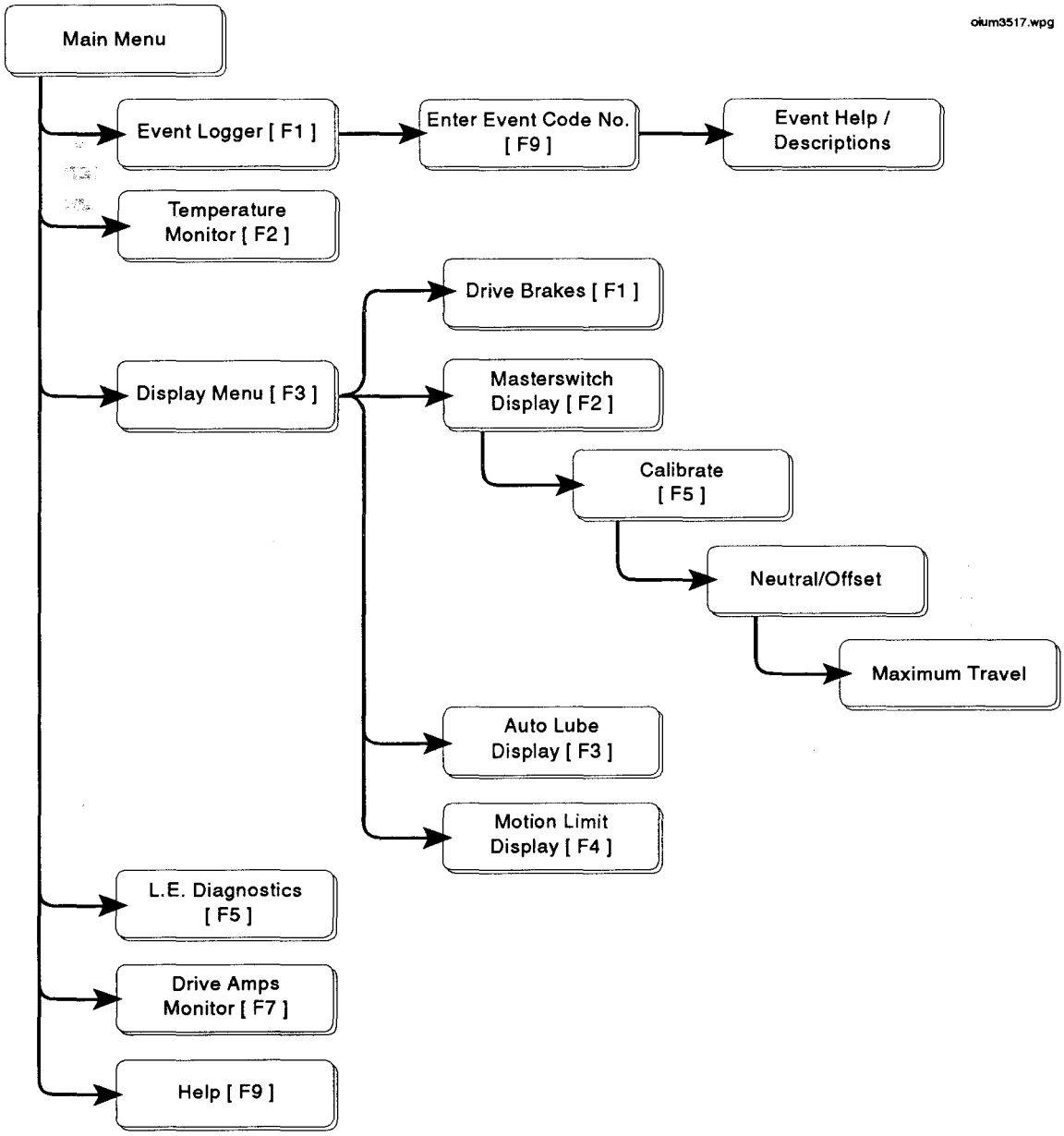
WEIGHTS

Shipping Weight, kgs	1,146,247
Export Shipping Weight, kgs.	1,168,927
Working Weight, kgs.	1,223,359
Counterweight	
Solid Plate	Provided with machine
Ballast, kgs. (Loose Punchings, Provided by Customer unless otherwise specified, @4005 kgs./cu.m)	77,112

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

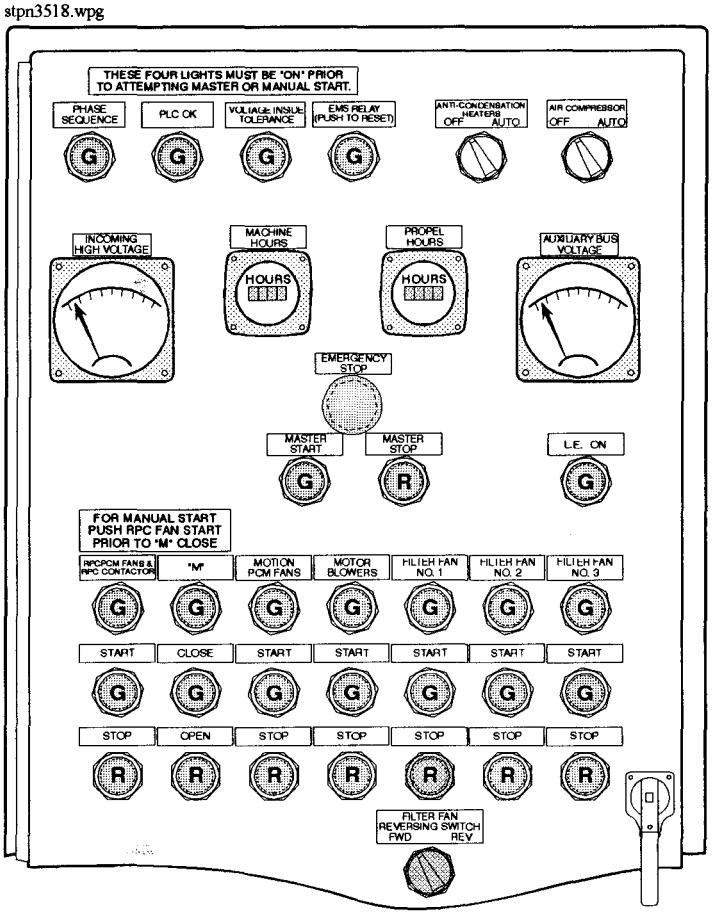
Patent Pending
Printed in U.S.A.

The following represents the flow of screens on the OIT:



For more information on the utilization of this Operator Interface Terminal in operating the machine, refer to the *MARION PROGRAMMABLE SYSTEM* manual for this machine.

stpn3518.wpg



EMERGENCY STOP - A red pushbutton which opens the main contactor on the Rotating Frame and shuts down all machine functions.

MASTER START - Pressing this pushbutton automatically starts, in sequence, the motor blowers, the filter fans and the PCM fans, and also closes the main contactor.

MASTER STOP - Pressing this pushbutton will sequentially stop all functions.

L.E. ON - A green light that indicates that Line Excitation is energized.

RPCPCM FANS & RPC CONTACTOR - A light and 2 pushbuttons, *START* and *STOP*, to control power to the main transformer which supplies power to the machine's operating drives, and for starting the Reactive Power Compensator Power Conversion Module fans.

- *The CLOSE* button closes the contacts in the contactor, energizes the transformer and starts the RPC fans. The green light indicates they are "*ON*" when lit.

NOTE: This control is inoperative unless the green EMS RELAY indicator is lit.

- *The OPEN* button opens the contacts in the contactor, de-energizes the main transformer, and stops the RPC PCM fans.

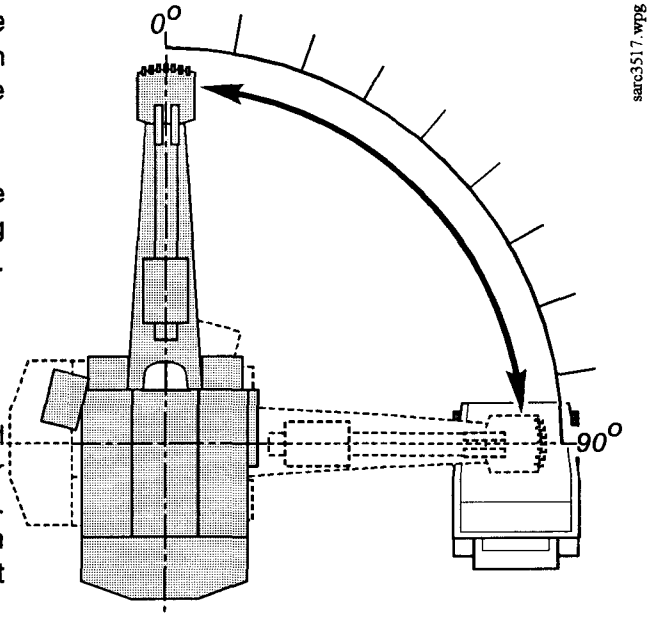
"*M*" - (Main Contactor) A light and 2 pushbuttons, *CLOSE* and *OPEN*, to control the Main Contactor.

MOTION PCM FANS - A light and 2 pushbuttons, *START* and *STOP*, to control the cooling fans for the power convertor modules. The green light indicates they are energized.

To maintain maximum output, the optimum swing angle for shovels is an arc of 30°-90° between the digging face and the dump point.

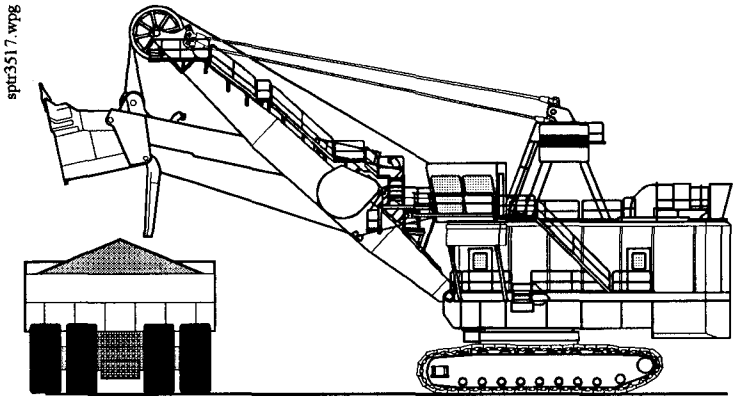
Greater than 90° swing arcs require the shovel to spend more time in the swing cycle between loading and dumping. This decreases production.

The shovel operator should spot the haul units. Do this by suspending the dipper above the spot where you want to dump. Each haul unit driver can then position his truck body in the center of this target area.



SWING ARC

CAUTION: Set the hoist brake to hold the loaded dipper in position if spotting time will exceed 30 seconds.



The working face often has difficult areas where blasting failed to fragmentize the rock or material. Avoid these areas while loading the truck. Loosen and break out the difficult/tight material while waiting on haul trucks to return.

SPOTTING the HAUL TRUCK

Haul truck spotting can also be done quickly by keeping the pit area immediately within the radius of the boom point clear of rocks and debris. This housekeeping practice can also reduce the cost of shovel crawler maintenance and haul truck tire expense.

CAUTION: Do not sweep rocks or blocks of material on the floor of the pit with the dipper. This practice will accelerate wear and cause serious machine damage.

The system consists of:

- One 300 gallon OGL reservoir fitted with an air operated lube pump (50:1 ratio).
- One 300 gallon MPG reservoir fitted with an air operated lube pump (50:1 ratio).
- Air supply from the compressed air system, with a manual shutoff valve for maintenance purposes and pressure regulators for adjusting the air pressure to the lube pumps.

CAUTION: The air line shutoff valve must be open during machine operation.

- Two solenoid controlled, air pilot operated, normally closed, 3-way valves that direct air to the lube pumps.
- Five solenoid controlled, air operated, 2-position valves to direct lube to the area determined by the timer.
- Lincoln type SL-1 high pressure lubricant injectors.
- Air and hydraulic pressure gauges located at strategic points for visually monitoring system operation.
- High pressure switches in each circuit which shutdown the pumps, terminating the lube cycles at 2500 PSI.
- Safety unloaders (factory set @ 3750 - 4250 PSI and non-adjustable) in the pump delivery lines to protect the lube system from excessive pressure.
- Electric control panel to control the operation of the lube circuits and locate faults.
- AC power supply network to control panel.
- Programmable controller located in the PLC 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 panels, and the lube reel are located in the enclosed Lube Room at the front, left corner of the machinery house. The 8 pressure switches used in the system are placed around the machine at locations to 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 5 automatic supply circuits will cycle.

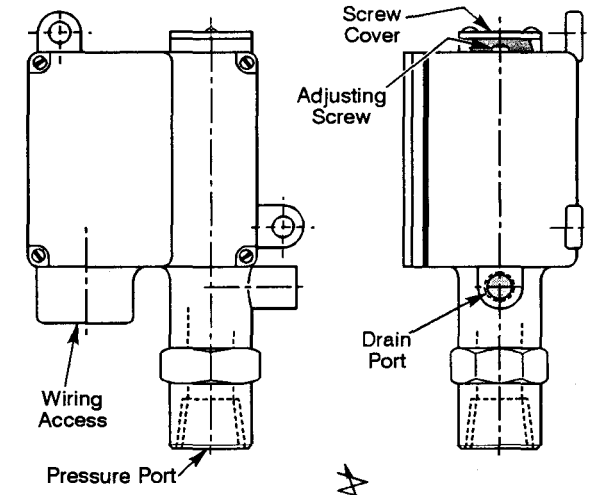
B. If the machine control is in the *PROPEL* mode, then only the crawler MPG circuit will cycle.

SAFETY UNLOADER VALVES

A Safety Unloader valve is provided in the OGL and MPG pump circuits to protect against excess lubricant pressure that could damage the system components. The unloader valve vents the lubricant directly to atmosphere when the circuit pressure exceeds 3750 PSI.

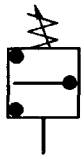
LUBE CIRCUIT PRESSURE SWITCHES

These high pressure switches are used to signal the controller (PC) that the lubricant pressure in a distribution circuit has attained the level sufficient for pump shutdown and cycle termination. There are eight (8) of these switches used on the machine in this automatic lubrication system. They are located at various points around the machine that best insure lube distribution has been made throughout the five circuits. Two of the 5 circuits contain 2 pressure switches each. They are the *Crawlers Dig/Propel MPG* circuit and the *Rotating Frame and Boom MPG* circuit.



swpres2d.wpg

Graphic Symbol:



These switches are all double make, double break units that have snap action switching elements. They automatically reset by a snap action of the switch. *DO NOT PLUG THE DRAIN PORT ON THE SWITCH.* Each switch is adjustable externally within the ranges listed on it. In this auto lube system, each switch is to be within the ranges listed on it. In this auto lube system, each switch is to be adjusted so its contacts open at 2500 PSI and re-close at 1900 PSI. Check these settings with a gauge installed in the circuit as close as possible to the switch while manually cycling the lube circuit.

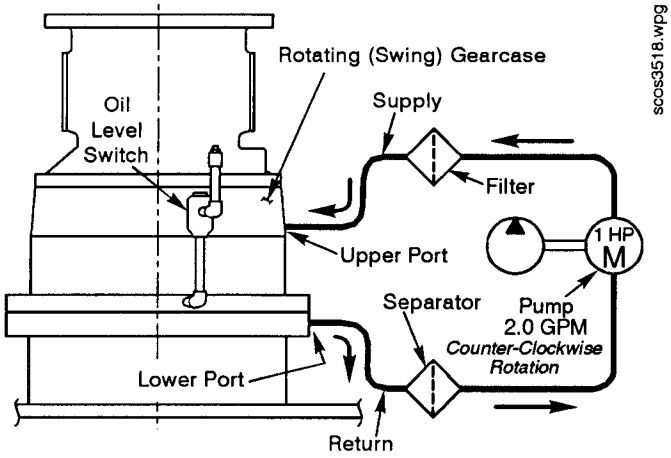
CODE	NAME	DESCRIPTION
GL	Gear Lubricant for Enclosed Gearcases with Through-hardened gears	This gear oil must have good load carrying and extreme pressure (E.P.) properties. The gears will be highly loaded and subjected to large shock loads. Fast stops, starts, and reversing action will be "normal" operation for the gears and bearings lubricated by this oil. Use as viscous a product as possible for maximum gear life. 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.
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" *~ 55 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: 22 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 Center Journal
Boom Support Socket Pins at 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
Dipper Trip Rope Guide Sheaves	Bushing	2	End of Shaft
Boom Support Socket Pins at Boom	Plain	4	End of Pin
Boom Point Sheaves	Anti-Friction	2	End of Shaft

GEARCASE OIL CIRCULATING SYSTEM ~ SWING

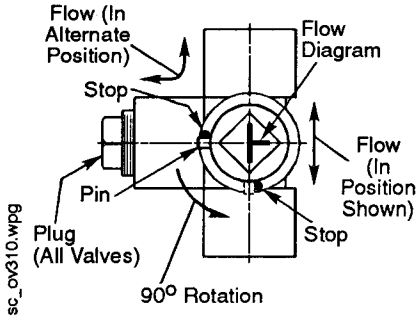
Each of the 2 Swing gearcases has a separate oil circulating system. Each system is located completely on the on the deck near each gearcase.



Schematic ~ SWING CIRCULATING PIPING

Each cooling system is turned on when the RTD temperature sensor in the gearcase or the thermostat located at the bottom of the gearcase senses that the oil temperature has reached 140°F (60°C). If any system fails to circulate oil after 6 seconds, the failure will be announced in the operator's cab with a pulsating buzzer and a light. If the alarm does sound, *DO NOT OPERATE THE MACHINE UNTIL THE PROBLEM HAS BEEN CORRECTED.* When filling either system with oil, add the oil to the gearcase. Run the cooler/pump to purge the lines of air and oil as required to obtain the proper level in the gearcase.

2-Position Valve:



NOTE: Before filling the system, check that all the 2-position valves are open and that the vent port is plugged.

CAUTION: FAILURE TO PURGE THE SYSTEM OF AIR COULD RESULT IN SEVERE DAMAGE TO THE GEARCASE.

FLOW SWITCH

Check that the flow switch is operational. When the system is operating, the red pointer will indicate oil flow and the switch should be closed. If the switch does not close during operation, adjust the switch as follows:

> *Remove the cover and replace the 4 screws. Hold the red pointer and loosen the slotted shaft nut. With the system operating, rotate the pointer towards the inlet until the switch is activated and tighten the nut. Hold the pointer and loosen the positioning screw and rotate the pointer to the midpoint on the scale and tighten the screw. Replace the cover.*

Page

PROCEDURE for USE of MECHANICAL TENSIONER on MAIN GEAR RODS

NOTES:

√ *The Standard Preload for this Mechanical Tensioner (1.5 Dia Rod)* —
Tighten the jack bolts on the tensioner to 49 Ft.Lbs. (98,400 Lbs. Clampload).

√ The rod threads should be clean and the fit of the tensioners and nuts on the rods should be very free. This is to allow for stretch of the rod during tensioning.

√ Perform Steps #2-#5 below completely for each Mechanical Tensioner — in the tightening sequence indicated in the overall view in the figure.

√ Due to stretching of long bolts and rods, Steps #4 and #5 below may have to be repeated to obtain the final preload.

BEFORE TENSIONING:

1. Seat the rails against the pilot shoulder in the gear with equal gaps between the rail ends.

2. Install the capscrews through the rails into the main rotating gear. Tighten to *900* Ft.Lbs.

3. Assemble all rods to the STANDOUT DIMENSION as shown in the figure.

√ After 20 hours of machine operation, repeat Step #5 for all the rods, in the sequence indicated.

Initial Tensioning:

1. To seat the threads and eliminate clearances, use a small wrench to tighten the jack bolts on the mechanical tensioner to 10% of the final torque required (Approx. 5 Ft.Lbs.). Tighten the jack bolts in the sequence indicated in Figure #1.

2. Switch to a torque wrench and tighten the jack bolts to 50% of the final torque required (Approx. 25 Ft.Lbs.), again using the sequence in Figure #1.

3. Re-tighten the jack bolts to 75% of the final torque required (Approx. 37 Ft.Lbs.) — however, use the sequence in Figure #2.

Final Tensioning:

4. Tighten the jack bolts to 110% of the final torque required (Approx. 54 Ft.Lbs.)using the sequence in Figure #2.

5. Tighten all the jack bolts to the final torque required (100%, Approx. 49 Ft.Lbs.) using the sequence in Figure #2.

4.2 CRAWLER BELTS

The Crawler Belts contact the ground and transfer the entire weight of the machine from the lower frame to the ground. Each belt is an endless shoe assembly that is moved by the propel machinery around the crawler side frame. One belt on each crawler consists of 47 cast alloy steel, non-cleated, double-pin connected shoes. The pins are retained in the shoes by lock bolts.

The pitch of a new belt is a nominal 20 inches. All the shoes assemble into the belt so that the male lugs on each shoe are toward the front of the machine when the shoe is on the bottom of the crawler frame.

CRAWLER BELT MAINTENANCE

1. Replace any missing or broken shoe pin lock bolts immediately.

2. To remove old shoe pins - drive them out if possible, burn them out if necessary.

3. Annually (5000 hrs.) remove any metal flow from the roller path on each shoe that interferes with belt motion. Use arc air to within .125 inch of final surface, then grind the remainder.

4. Monitor the fit of the shoes or belt to the drive sprocket monthly (420 hrs.)

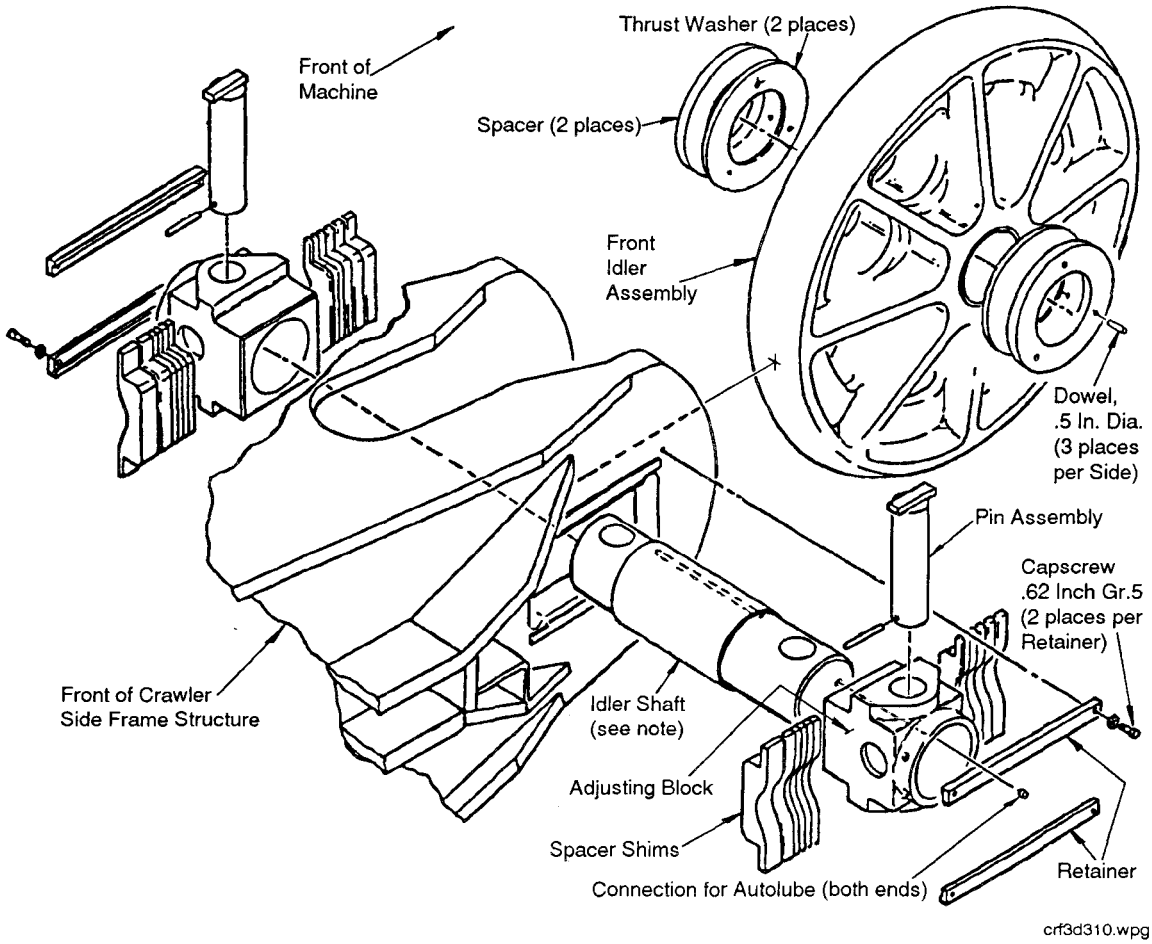
   √ Record wear rate.

   √ Replace shoes or rebuild drive lugs as needed.

   √ Replace sprocket or rebuild wear areas as needed.

5. Replace or rebuild the slide bars on the crawler side frame *BEFORE* the drive lugs on the shoes touch the top of the crawler.

IMPORTANT! *PROPERLY ADJUSTED BELTS REDUCE THEIR WEAR RATE AND PROLONGS THEIR SERVICE LIFE!*



CRAWLER FRONT IDLER ASSEMBLY

NOTES: — Install the Front Idler Shaft with the groove toward the front of the crawler, and the lube hole toward the top.

— Install the Adjusting Block with its Jack Depression toward the rear of the machine.

CRAWLER FRONT IDLER ROLLER ASSEMBLY

The front idler roller carries the machine weight in conjunction with the load rollers. Each roller turns about the idler shaft on bronze bushings. The idler shaft mounting consists of slide blocks which can be moved to the front or rear to compensate for crawler belt wear. Shims located on either side of each slide block are used to maintain the roller position. To remove the front idler:

1. Park the machine in a level area leaving several inches of clearance under the front idler to be removed.

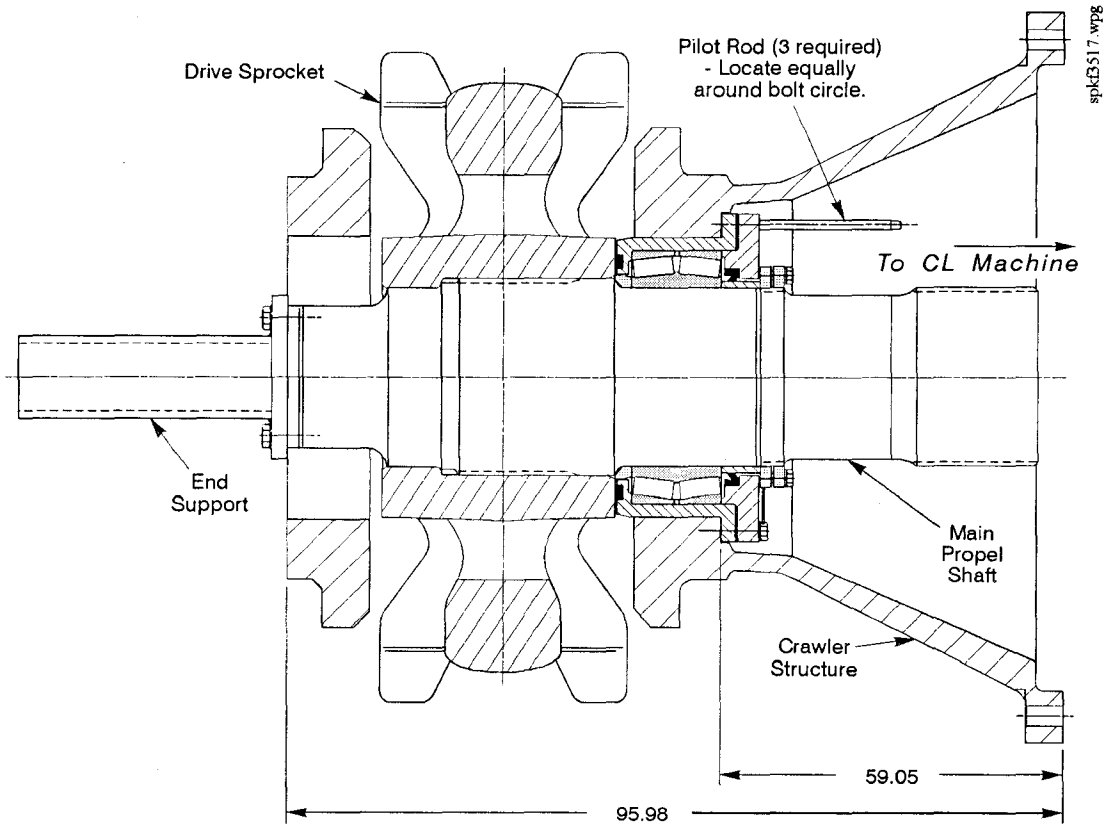
2. Rotate the rotating frame to provide crane access to crawler belt and idler.

3. Remove the shim retainer bars, lube lines and shims ahead of the slide blocks.

16. Use the spacer between the bearing race and shaft shoulder as a puller. Six tapped holes (M20 x 25) are provided to attach the threaded rods and hardware required. Hydraulic expansion of the inner race is also provided to ease the pulling force. Attach the hydraulic pump provided with the machine to the .25 inch hole in the end of the sprocket shaft. Use hydraulic pressure and pulling force simultaneously to remove the bearing race.

17. Remove the 18 - 1 Inch capscrews which secure the cartridge and retainer to the crawler. *DO NOT* remove the 6 capscrews which secure the retainer to the cartridge.

18. Install a pulling eye in the (M42 x 4.5 x 44 mm) tapped hole provided and using the fixtures shown, remove the sprocket shaft.

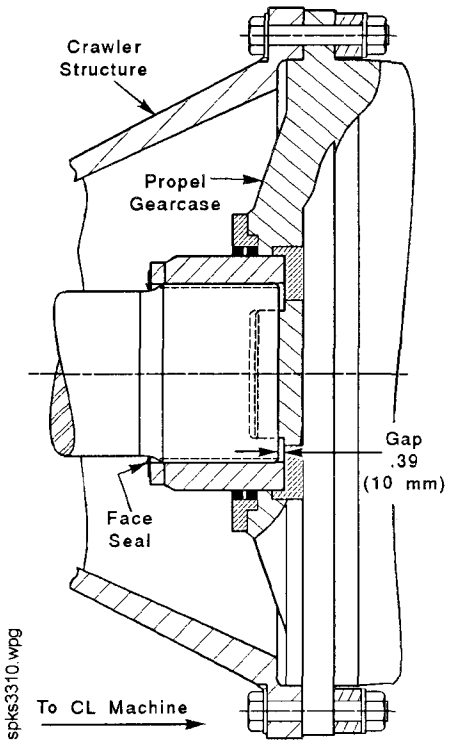


FIXTURE for the MAIN PROPEL SHAFT

19. Lift the sprocket clear of the crawler after the shaft has been removed.

20. Inspect all parts for damage or wear. Replace or repair as required. Refer to the "Main Propel Shaft" for disassembly and rework.

2. Install the a new face seal onto the propel shaft as shown in the sketch.



3. Pack the rear of the spline cavity in the propel gearcase for the main propel shaft with 1 pint of Molub-Alloy grease paste (P/C 480206-3) or equivalent.

4. Coat the internal and external spline surfaces and all shaft pilot surfaces with Molub-Alloy grease paste or equivalent.

5. Install the gearcase by engaging the splines of the gearcase with the main propel shaft and the pilot register of the gearcase with the crawler housing. Install the spacer and 36 fasteners and tighten to 7,380 Ft.Lbs.

NOTE: Align the match marks if the same gearcase is being reinstalled. This will minimize the time required to align the coupling. If a *NEW* gearcase is being installed, add new match marks after the gearcase has been installed and the coupling aligned.

6. Fill the gearcase with the proper lubricant to the specified capacity. Refer to Section 3 - LUBRICATION, in this manual. Be sure to install the breather and case plugs.

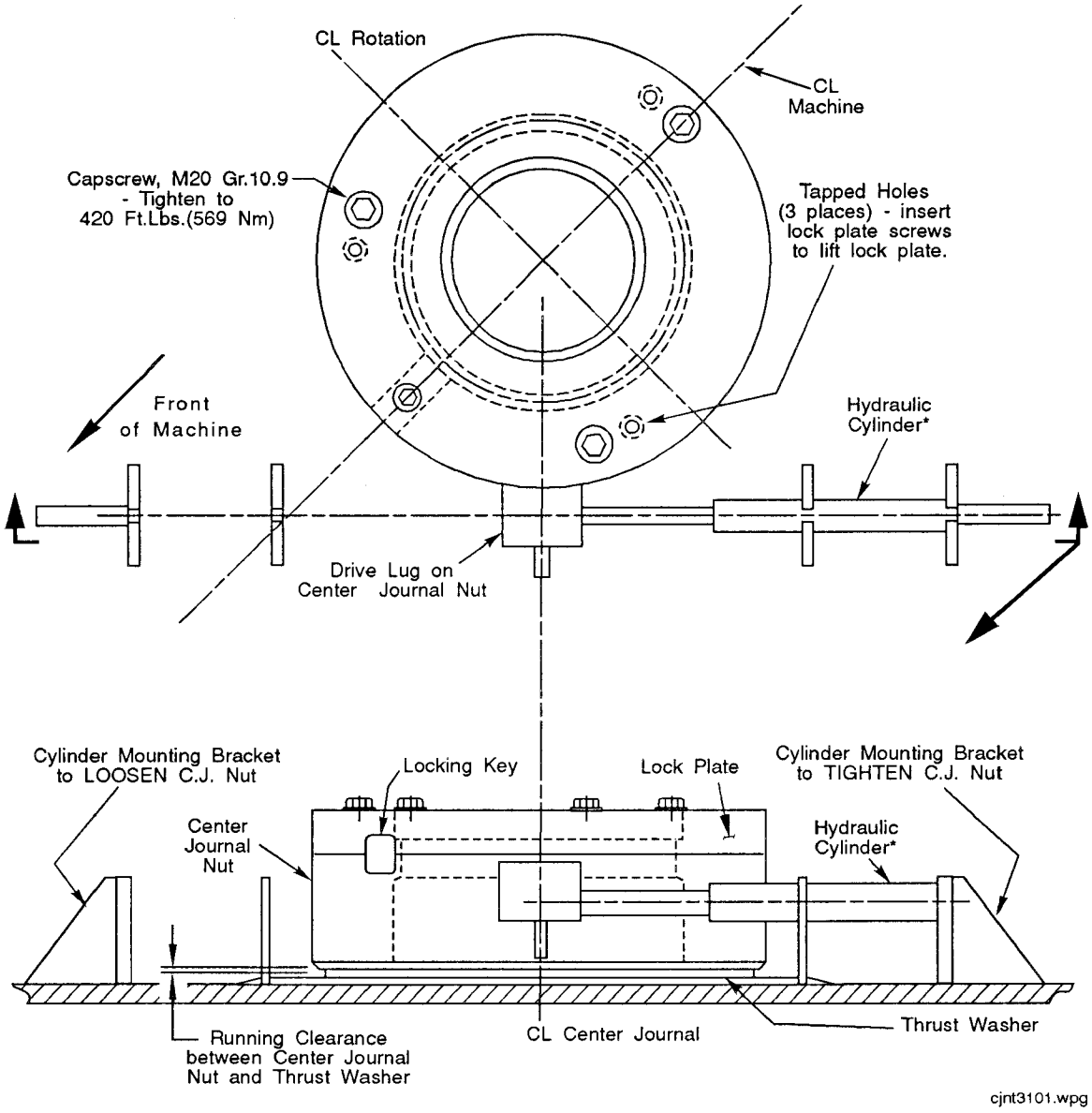
7. The reassembly of the propel motor coupling can be assisted by releasing the disc brake with the manual override on the air control valve. This will allow the rotation of the motor shaft.

8. Align the motor coupling per the specifications in Section 6 - BRAKES AND COUPLINGS, in this manual. Install the grids and cover.

9. Fill the propel motor coupling to the recommended level with special long term grease (P/C 295148-7).

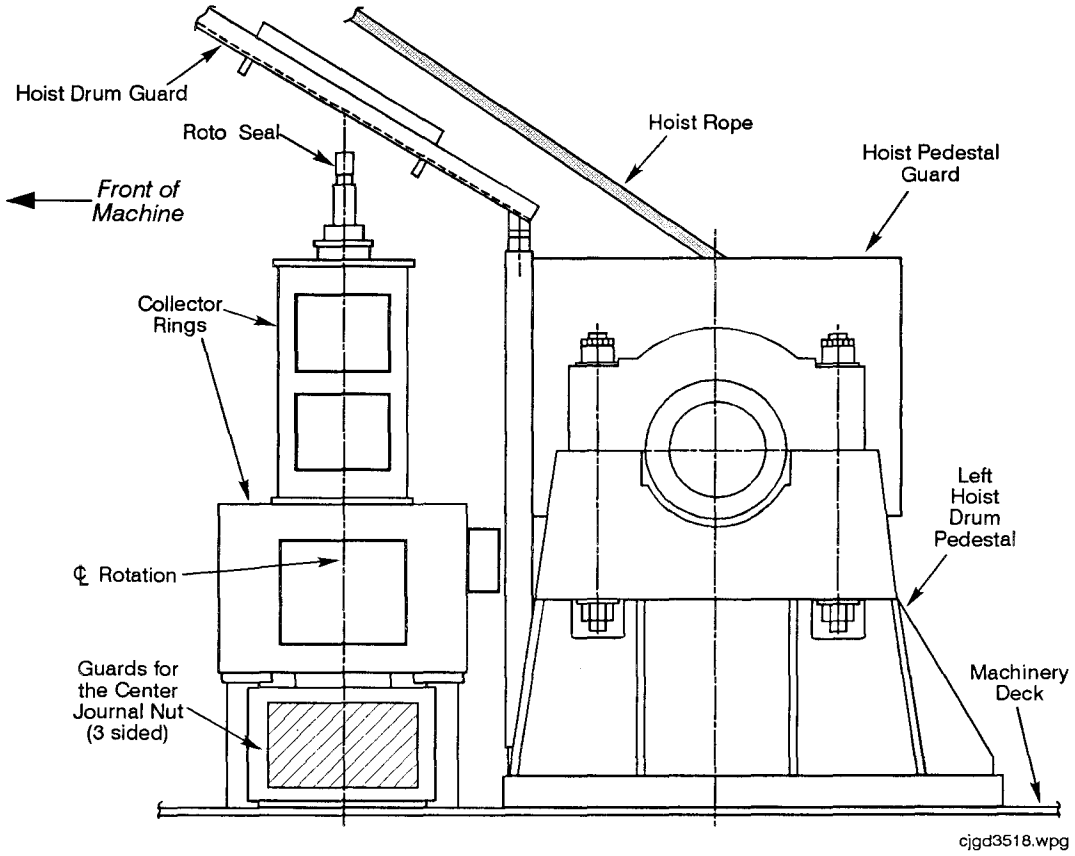
10. Install the cable reel, if furnished, with the machine and reconnect the trail cable.

DANGER: HIGH VOLTAGE ~RE-CONNECTION OF THE TRAIL CABLE SHOULD ONLY BE PERFORMED BY A QUALIFIED ELECTRICIAN. Failure to comply could result in severe bodily injury or death.



SET-UP for the CENTER JOURNAL NUT ADJUSTMENT

**The Hydraulic Cylinder is supplied with the Tools furnished with this machine.*



VIEW of the GUARDS for the CENTER JOURNAL NUT

PEDESTAL RODS MECHANICAL TENSIONER PROCEDURE

NOTES:

√ *The Standard Preload for this Mechanical Tensioner (2.25 Dia Rod)* —
Tighten the Jack bolts on the tensioner to 114 Ft.Lbs. (175,200 Lbs. Clampload).

√ The rod threads should be clean and the fit of the tensioners and nuts on the rods should be very free. This is to allow for stretch of the rod during tensioning.

√ Perform Steps #2-#5 below completely for each Mechanical Tensioner — in the tightening sequence indicated in the overall view in the figure.

√ Due to stretching of long bolts and rods, Steps #4 and #5 below may have to be repeated to obtain the final preload.

√ After 20 hours of machine operation, repeat Step #5 for all the rods, in the sequence indicated.

Initial Tensioning:

1. To seat the threads and eliminate clearances, use a small wrench to tighten the jack bolts on the mechanical tensioner to 10% of the final torque required (Approx. 11 Ft.Lbs.). Tighten the jack bolts in the sequence indicated in Figure #1.

2. Switch to a torque wrench and tighten the jack bolts to 50% of the final torque required (Approx. 57 Ft.Lbs.), again using the sequence in Figure #1.

3. Re-tighten the jack bolts to 75% of the final torque required (Approx. 86 Ft.Lbs.) — however, use the sequence in Figure #2.

Final Tensioning:

4. Tighten the jack bolts to 110% of the final torque required (Approx. 125 Ft.Lbs.)using the sequence in Figure #2.

5. Tighten all the jack bolts to the final torque required (100%, Approx. 114 Ft.Lbs.) using the sequence in Figure #2.

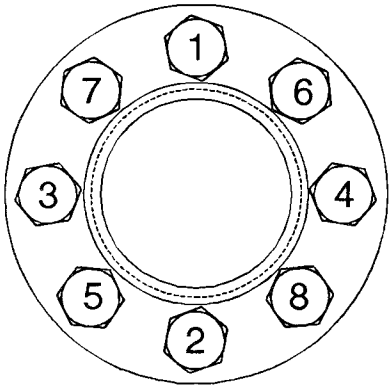


Figure #1
Initial Tightening Sequence For Special Nut

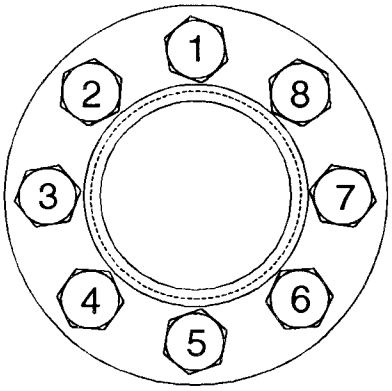
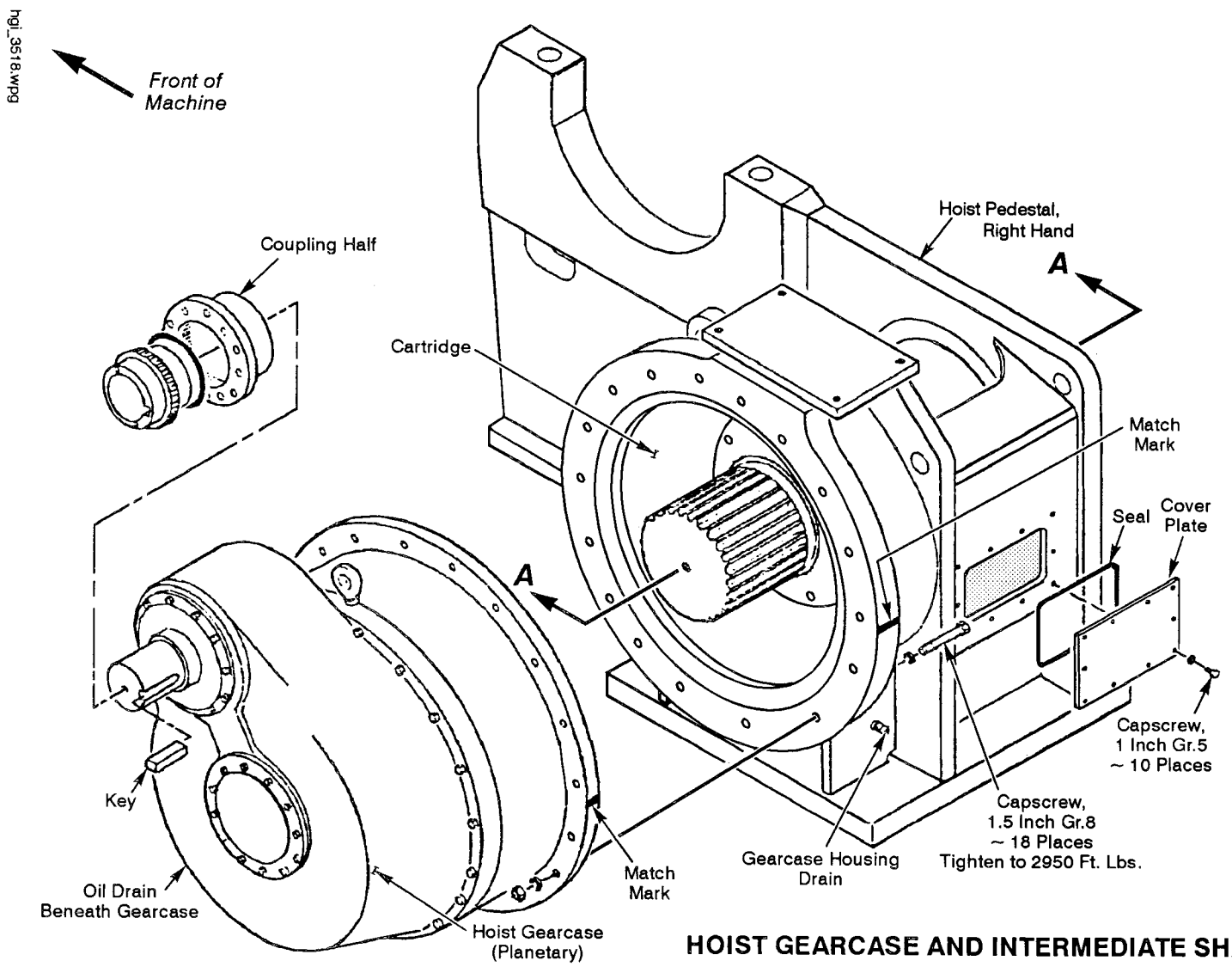
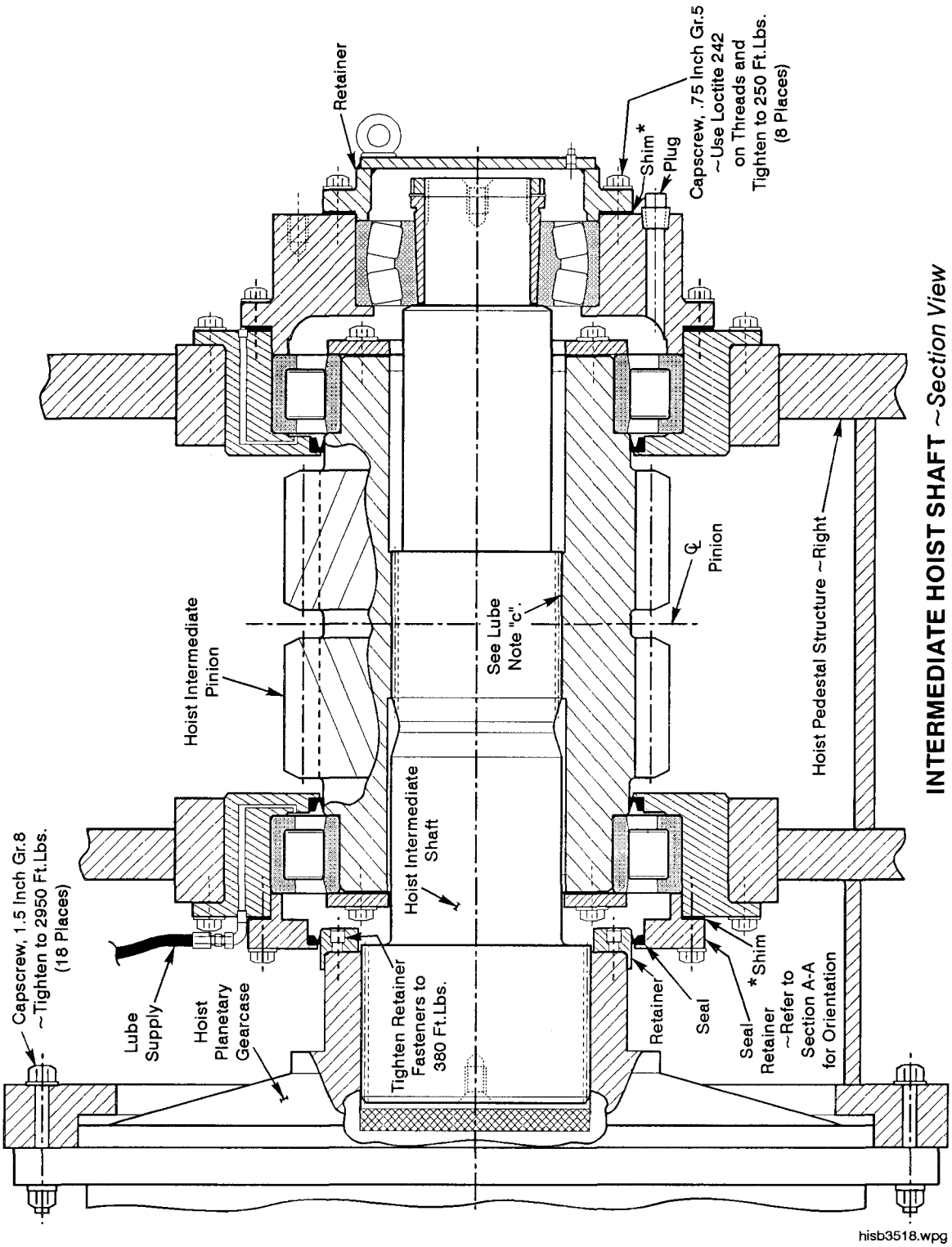


Figure #2
Final Tightening Sequence For Special Nut



HOIST GEARCASE AND INTERMEDIATE SHAFT

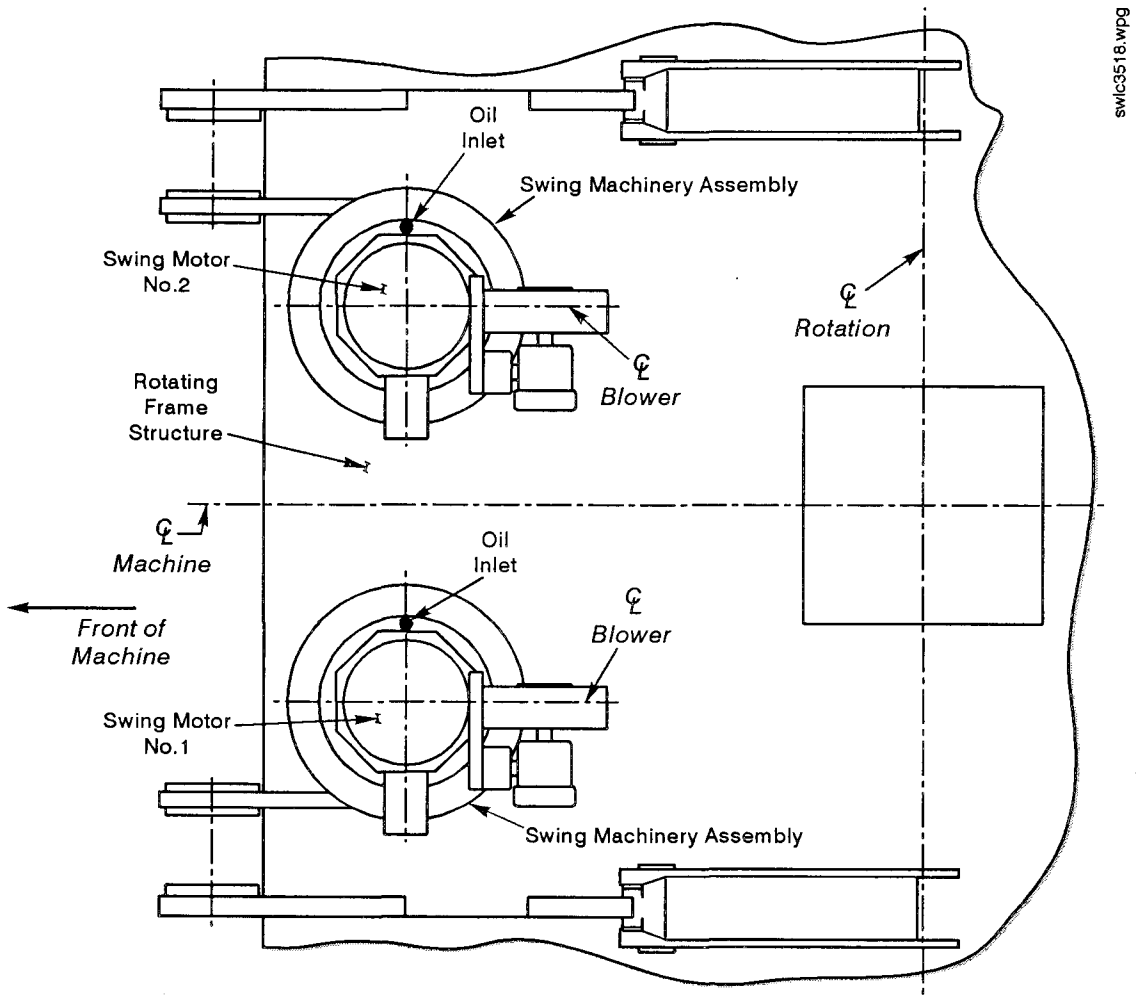


INTERMEDIATE HOIST SHAFT ~*Section View*

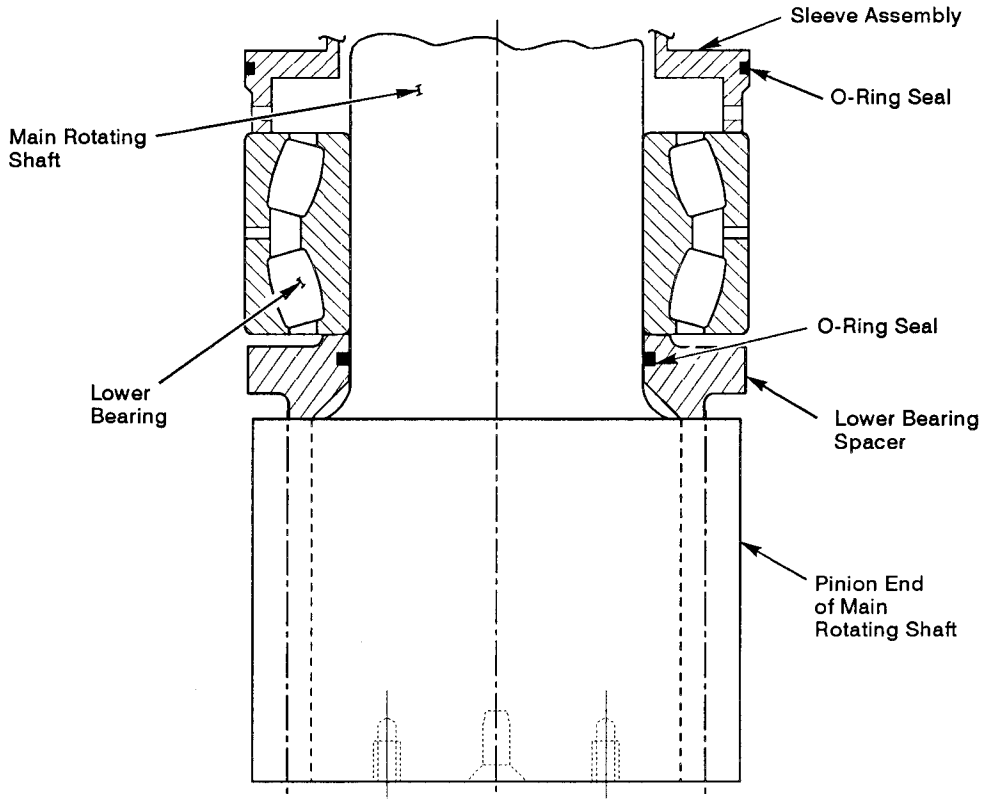
4.7 SWING MACHINERY

The swing machinery is mounted on the rotating frame structure. Two assemblies are used, each consisting of a brake, motor, double reduction gearcase and a main rotating shaft. The main rotating pinion, located at the bottom of the main rotating shaft, engages the main rotating gear which is mounted on the lower frame.

NOTE: Install the rotating gearcase assemblies with the ℄ Blower parallel to the ℄ machine as shown below:



SWING MACHINERY INSTALLATION ~ *Plan View*



MAIN ROTATING SHAFT LOWER BEARING ASSEMBLY

7. Heat the bottom bearing to 194°F (90°C). Use a suitable puller to pull the bearing from the shaft.

8. Pull the bearing spacer from the shaft, then remove the O-Ring seal from the spacer.

MAIN ROTATING SHAFT ~ *ASSEMBLY*

1. Position the shaft vertically, with the pinion end DOWN. Refer to the figure on page 4.7.9.

2. Install the O-Ring onto the bearing spacer and, from the top end of the shaft, install the spacer onto the shaft.

3 .Heat the bottom bearing to 194°F (90°C) and install onto the shaft.

4. Install the O-Ring onto the sleeve and install the sleeve onto the shaft. Install the V-Seal onto the top of the sleeve.

5. Insert the top bearing into the bearing housing. Heat the top bearing and housing assembly to 194°F (90°C) and install the assembly onto the shaft.

BOOM POINT SHEAVE ASSEMBLY REMOVAL

The Boom Point Sheave assembly can be removed from the boom while the boom is in its normal raised position using the proper lifting equipment. Access to the caps on the boom point shaft and to the bearing retainer bolts on the inboard end of the assembly is best gained from a man-basket suspended from a crane. *DO NOT damage the hoist ropes during this procedure.*

1. Park the machine in a safe, level work area.

2. SLOWLY crowd the dipper handle out until it reaches its audible limit; then extend it very slowly until it stops and the crowd brakes set.

3. Place the crowd brake selector switch in the *SET* position.

4. Lower the dipper/handle to the ground.

5. Slacken the hoist ropes so they can be lifted and removed from the point sheaves. Set all brakes and shut down the machine.

6. Disconnect the auto lube line from the inboard end of the sheave assembly to be removed.

7. Remove the 3 - 1.25 Inch capscrews holding the bearing retainer to the boom structure and shaft cap, at the inboard end of the shaft.

8. Lift the hoist ropes clear of the sheave to be removed. Lay the ropes on the boom structure and protect them against damage.

9. Support the sheave assembly with a crane.

10. Remove the 4 capscrews which secure the 2 bearing caps to the boom point.

11. Match-Mark and remove the bearing caps.

12. Lift the sheave assembly out of its housing and lower it to the ground. Set the assembly securely on cribbing *with the bearing retainer up.*

f. Shim gap "A" and gap "B" of the shaft as specified for the shipper shaft gear installation. (Refer to page 4.9.14 of this section.)

10. If the shipper shaft is to be replaced, continue to pull the shaft after the pinion has been removed. Move the sling to the center of the shaft and lift it clear of the boom.

RIGHT or LEFT CROWD GEARCASE REMOVAL

1. Park the machine on a level work area with ample room for a crane.

2. Set all brakes and shut down the machine.

3. Remove the crowd gear guard. If the left hand gearcase is to be removed, isolate, disconnect and remove the crowd limit before removing the guard.

4. Remove the boom walkway over the crowd gearcase and the motor coupling guard.

5. Remove the motor coupling housing and grids. Store in a clean area.

6. Note the position of the gearcase and match mark with the mounting bracket if none can be found.

7. Attach a sling to the lifting eye provided and take the weight of the gearcase.

8. Remove the 24 - .75 In. capscrews which secure the gearcase to the boom. *Note that the lower front 4 capscrews are installed with the head toward the center of the boom.*

9. Move the case toward the center of the boom until the intermediate pinion clears the mounting bracket bore, then hoist it clear of the boom.

Install the gearcase in the reverse order of removal.

√ Check coupling alignment and fill with L.T.G. It may be necessary to release the crowd brake to align the grid slots.

√ Fill the gearcase with HGL. Check for leaks after one (1) hour of operation. Refer to Section 3 of this manual for the lube requirements and oil cooler maintenance.

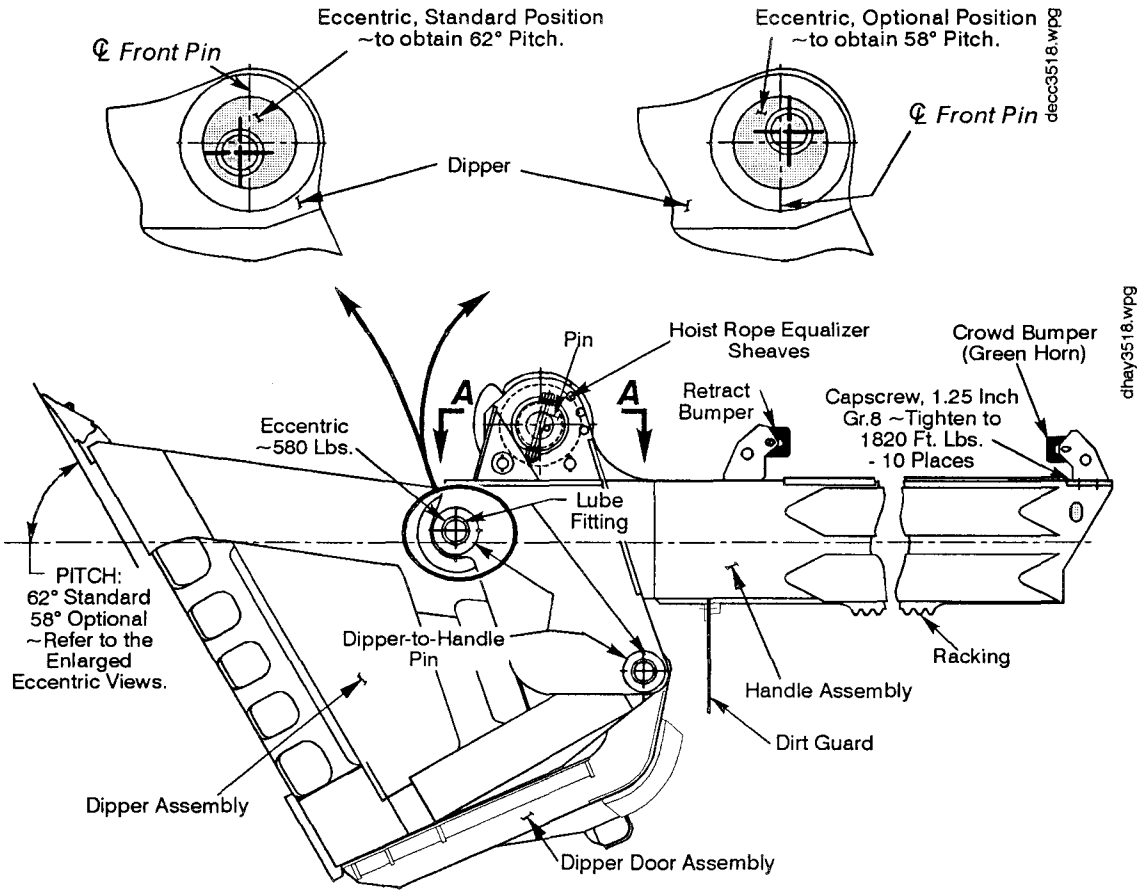
√ Be sure all guards are in place.

The crowd gearcase module includes 2 reductions, a right angle spiral bevel 1st reduction and planetary reduction. To minimize downtime, 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 the maintenance shop for repairs.

4.10 DIPPER / HANDLE ASSEMBLY

This machine uses a single-stick handle with machine cut racking. Bumpers, or green-horns, are provided to limit the crowd and retract travel. The dipper and dipper door are pin connected to the end of the handle, which forms the dipper back. Using the eccentrics provided, the dipper pitch can be set at 62° (Standard) or 58° (Optional) to suit pit conditions.

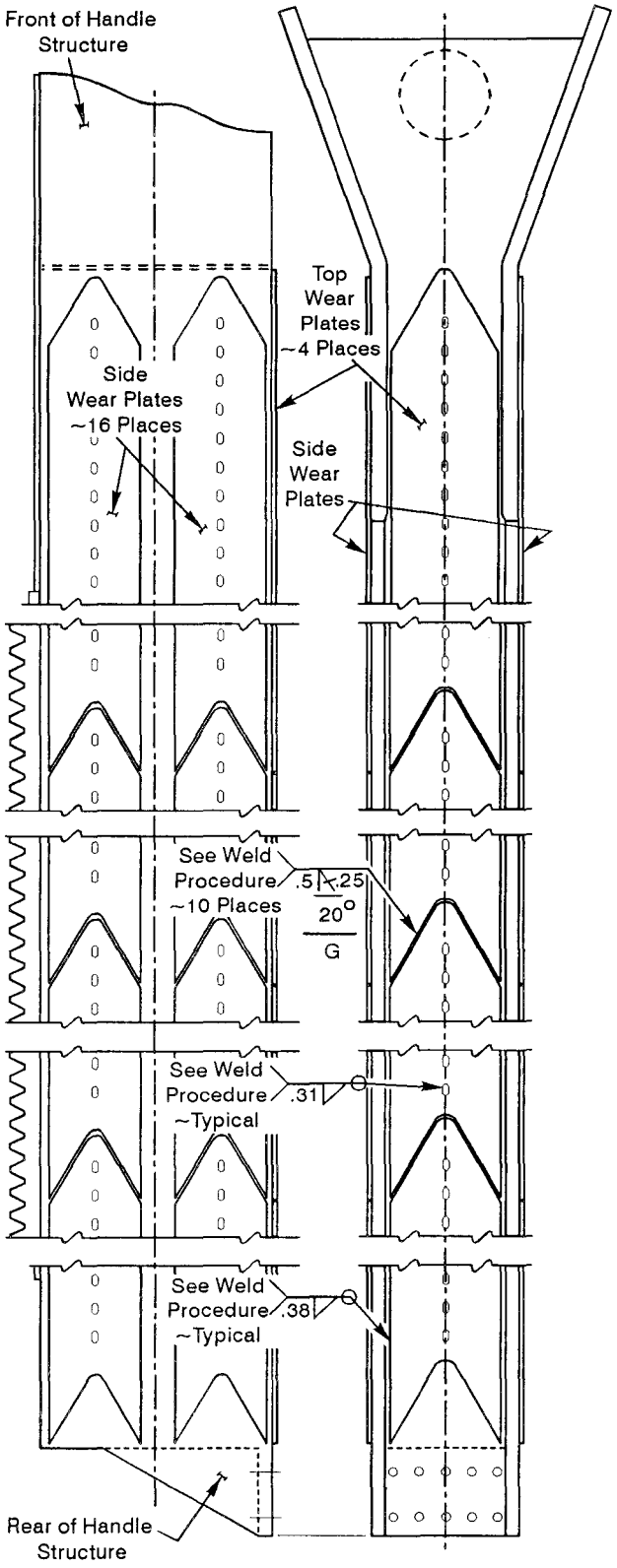


WEAR PLATE REPLACEMENT

(Top and Sides of Handle)

Welding Procedure for Wear Plates:

1. Each wear plate must be flat and in contact with the surface of the handle.
2. Preheat to 200°F.
3. Use weld wire E70 GMAW-FCAW.
4. Weld *MUST NOT* protrude above the top surface of *ANY* wear plate.
5. The welding sequence to be as follows:
   - A. Fillet welds in slots.
   - B. Beveled joints between plates.
   - C. Outside edges.



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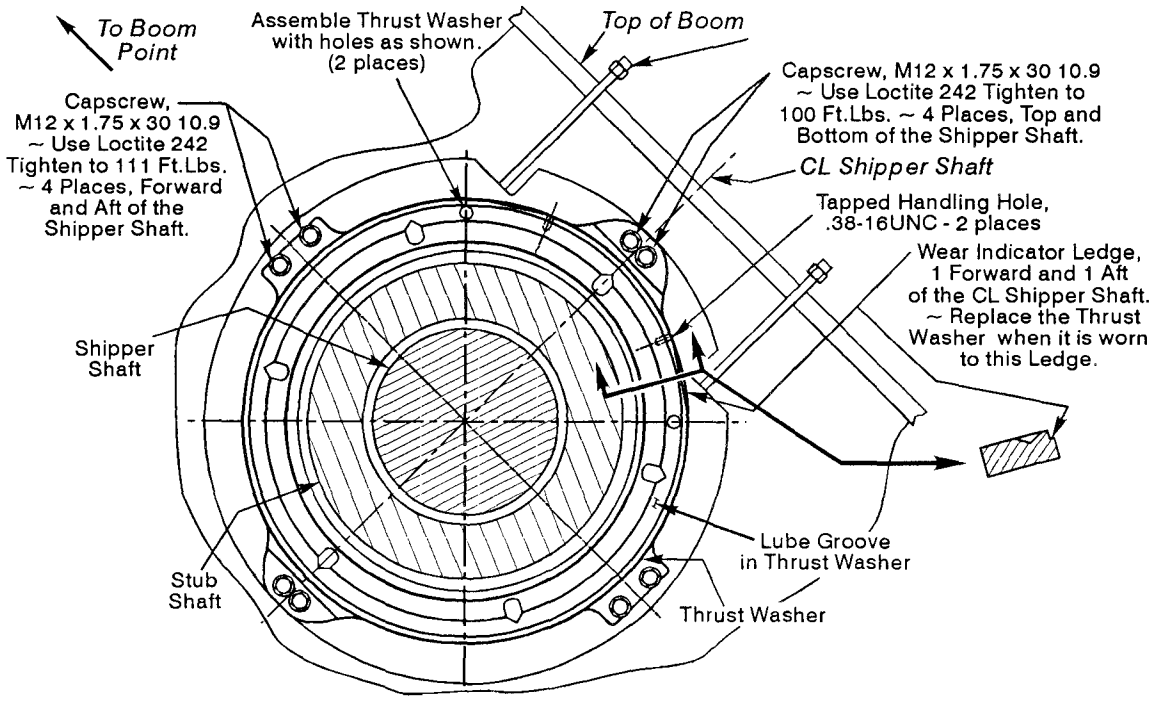


THRUSTWASHER ~ YOKE BLOCK
(R.H. Shown, L.H. Opposite)

4. Remove the worn Thrustwasher and install the new one. Use loctite 242 on the capscrews which secure the washers to the boom.

NOTE: Check to insure that the lube holes are aligned and that the lube system operates properly before installing the trunnions and the yoke block.

5. Install the trunnions and shipper shaft pinions. Check all parts for wear or damage. Replace as required.

6. Raise the boom and install the dipper handle. Refer to the proper procedures.

DIPPER DOOR REMOVAL

1. Remove the snubber spring pressure by loosening the adjusting nuts and disconnect the snubber links on the door.

2. Extend the dipper and open the door. *Slowly* lower the dipper on to cribbing (or a pile of rubble). The door should be hanging unlatched and free to swing. *SET ALL BRAKES.*

3. Remove the socket from the end of the Dipper Trip Rope. Pull the rope through both sheaves on the dipper door and tie it back out of the way.

4. Remove the retaining collars by cutting the weld connection.

5. Attach a sling to the door and lift it until the hinge pins with snubbers can be removed.

6. Lift the door clear of the machine.

The door installation is the reverse of removal. Inspect all parts at removal and replace as required.

- ✓ Re-weld all lock collars and grind smooth.
- ✓ Adjust the snubber spring pressure.
- ✓ Lube all bushings.

DIPPER DOOR SNUBBER ADJUSTMENT

The snubbers are properly adjusted when the door will close and latch consistently, and without slamming, as the dipper is lowered to its initial digging position. The snubbers should be adjusted equally to evenly distribute wear.

1. Back off the lock nut on the adjusting spring rod.

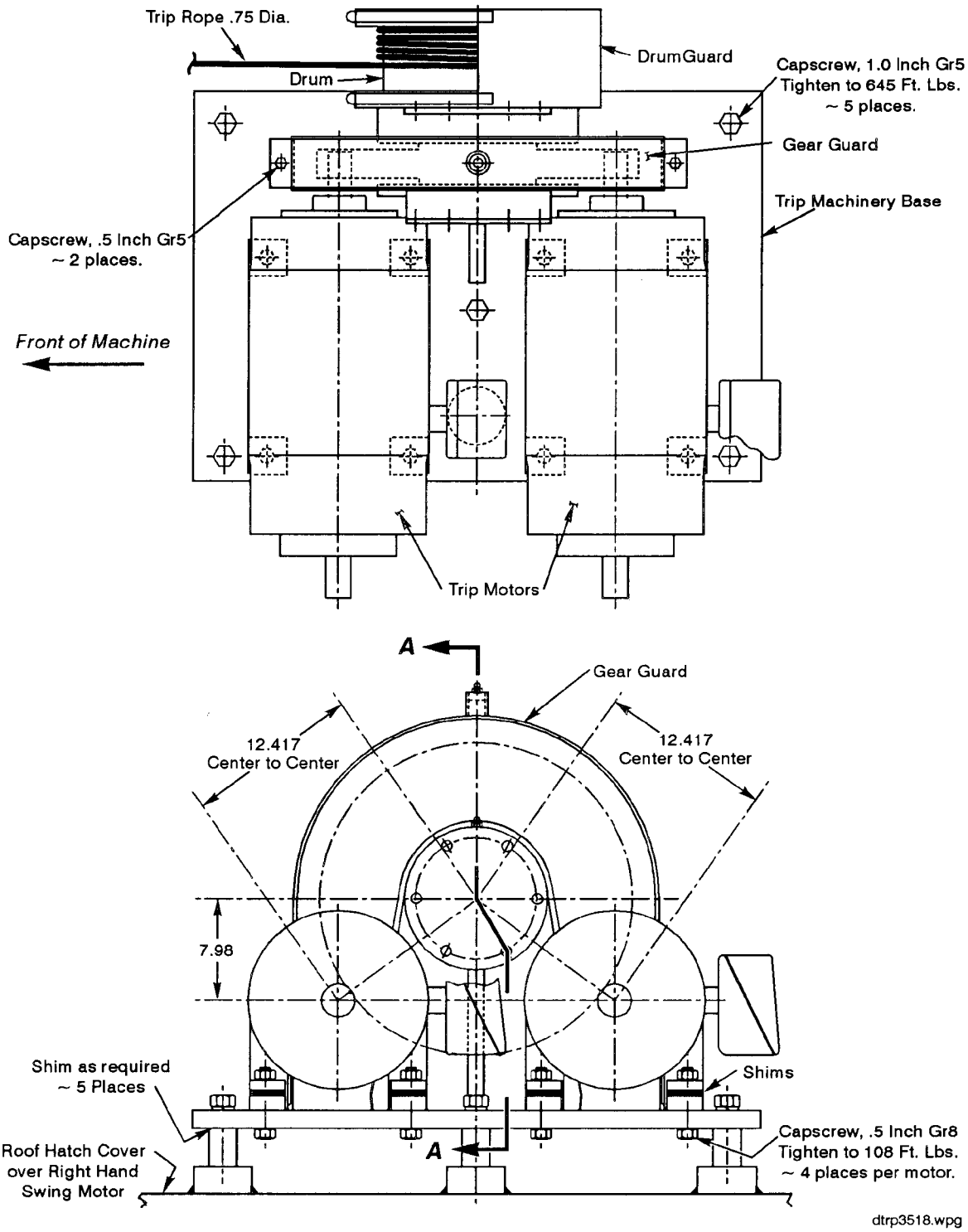
2. Tighten the adjusting nut on the rod until the spring height is 6.00 inches. Check the snubber operation.

3. If additional adjustment is required, adjust the spring force on the friction discs by turning the adjusting nut on the rod until the door closes and latches without excessive swing each time the dipper is lowered. Adjust the nut in ½ turn increments.

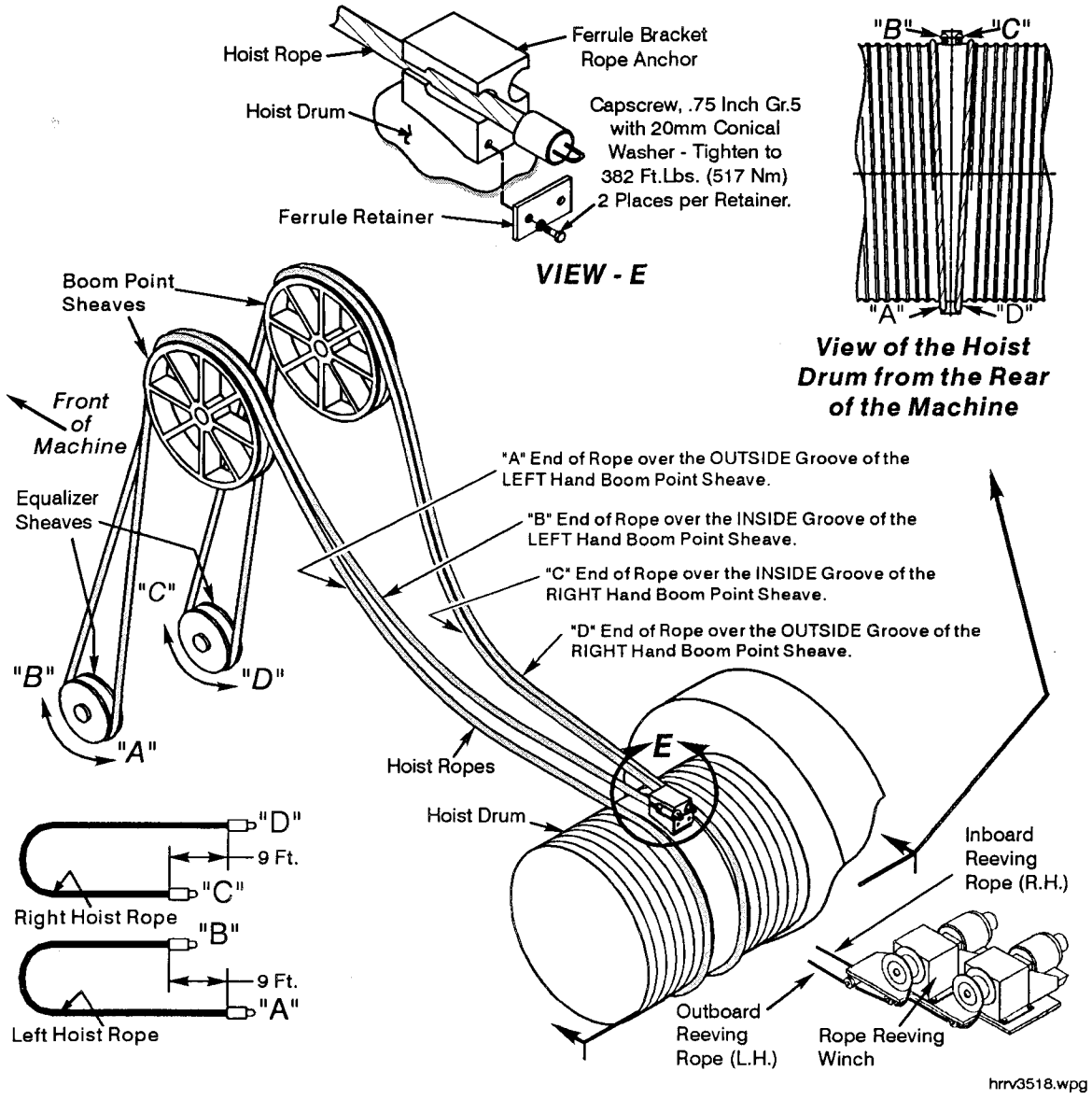
> *IMPORTANT: The minimum adjusted spring height is 5.12 inches.* Further adjustment will damage the springs.

4. When the desired operation is obtained, tighten the locknut against the adjusting nut.

CAUTION: DO NOT OVER-TIGHTEN THE SNUBBERS. Adjust both snubbers equally.



DIPPER TRIP MACHINERY
(1900 LBS.)



HOIST ROPE INSTALLATION

INSTALLATION NOTES:

1. Route the *left,* outboard winch rope over the boom point sheave and attach it to the *LH* hoist rope ends "A" and "B". — Route the *right,* inboard winch rope over the boom point sheave and attach it to the *RH* hoist rope ends "C" & "D".

2. Pull all 4 ends of the hoist ropes over the boom point sheaves simultaneously. Use spacer bars at the connections between the winch ropes and hoist rope ends to maintain spacing between the hoist ropes as they pass over the boom point sheaves.

INTRODUCTION

This parts guide is designed to assist in ordering replacement parts for current and obsolete standard gear drives.

Consult Falk for special or modified units.

TO ASSURE RECEIPT OF CORRECT PARTS, YOUR ORDER MUST INCLUDE THE UNIT MODEL NO., M.O. NUMBER (SERIAL NUMBER) AND RATIO WHICH ARE STAMPED ON THE REDUCER NAMEPLATE.

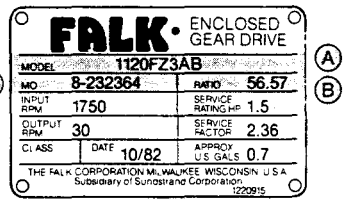
(A) Model
(B) Ratio
(C) M.O. Number
(D) Ref. No. & Part Description

How to find these items is explained in steps 1 & 2 below.

1 IDENTIFY UNIT:

- Record Unit Model, Ratio and M.O. Number from name plate.

SAMPLE NAMEPLATE

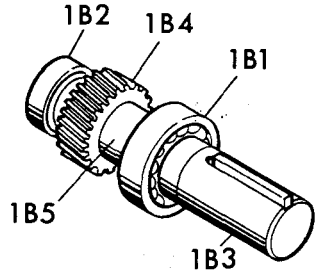


(A) MODEL 1120 FZ 3 A B
Unit Size
Unit Type
(B) RATIO 56.57
(C) M.O. 8-232364

- Check that your unit's Model and Ratio range are covered by this parts guide. If not, contact your Falk Representative.

2 IDENTIFY INDIVIDUAL PARTS:

- Use exploded view and parts list on Pages 2 & 3.



Ref. No.	Part Description
1B1 1B2 1B3	Outer Bearing Inner Bearing Shaft
1B4	Pinion
1B5	Spacer

(D)

Note: Shaft hardware is included with shafts.

Note: Replace seals, shims, and gaskets whenever reassembling a reducer.

3 DOES THIS RESTRICTION APPLY?

- Components shown (in non-shaded areas) in Tables 2 & 3, Page 4, are factory assembled using high interference fits and CANNOT be replaced individually.
- Use the Unit Size and Ratio to determine if this restriction applies.

Table 2 1B & 3A Shaft Assembly (1060-1130 & 60-130 Model M)

Ratio	UNIT SIZE								Ratio
	1060/60	1070/70	1080/80	1090/90	1100/100	1110/110	1120/120	1130/130	
38.44	1B1, 1B3, 1B4 & 1B5								38.44
47.08									47.08
57.66									25.63
70.62									70.62

4 PREPARE ORDER INFORMATION:

	Model
(A)	1120FZ3AB
	Ratio
(B)	56.57
	M.O.
(C)	8-232364
	Ref. No. & Part Description
(D)	1B4 Pinion

- Direct your order to a Falk Representative or Distributor.

5 PRICING PARTS

- Refer to Parts Price List below or contact the Falk Representative or Distributor serving your area.

Unit Size	Parts Price List
1020-1130 & 20-130 (Mod. M)	314-110
20-130 (Models A & B)	314-120

CORROSION PROTECTION AND STORAGE

CAUTION: Follow guidelines below to avoid damage to parts.

1. For domestic or indoor storage, Factory provides standard 24 month protection as boxed or optional 24 month protection for individual parts.
2. For export or outdoor storage, Factory provides optional 18 month protection.

CAUTION: This protection does not cover exposure to elements such as standing water, etc.

INTRODUCTION

The following instructions apply to all standard Falk Series F gear units. If a unit is furnished with special features, refer to the supplementary instructions shipped with the unit.

Credit for long service and dependable operation of a gear drive is often given to the engineers who designed it, or the craftsmen who constructed it, or the sales engineer who recommended the type and size. Ultimate credit belongs to the mechanic on the job who worked to make the foundation rigid and level, who accurately aligned the shafts and carefully installed the accessories, and who made sure that the drive received regular lubrication. The details of this important job are the subject of this manual.

WARRANTY—The Falk Corporation (the "Company") warrants that, for a period of one year from the date of shipment, the product described herein will deliver successfully its rated output as indicated on the nameplate, provided, it is properly installed and maintained, correctly lubricated, and operated in the environment and within the limits of speed, torque or other load conditions for which it was sold. Such product is expressly not warranted against failure or unsatisfactory operation resulting from dynamic vibrations imposed upon it by the drive system in which it is installed unless the nature of such vibrations has been fully defined and expressly accepted in writing by the Company as a condition of operation.

CAUTION

Consult applicable local and national safety codes for proper guarding of rotating members.

Lock out power source and remove all external loads from unit before servicing unit or accessories.

INSTALLATION INSTRUCTIONS

FOR SATISFACTORY PERFORMANCE,
CAREFULLY FOLLOW THESE INSTRUCTIONS

WELDING—Do not weld the gear unit housing or accessories without prior approval from The Falk Corporation. Welding on the unit may cause distortion of the housing or damage to the bearings and gear teeth. Welding without prior approval will void the warranty.

NAMEPLATE—Operate unit only at horsepower, speed and ratio shown on nameplate. Before changing any one of these, submit complete nameplate data and new application conditions to the Factory for correct oil level, parts and application approval.

TIGHTENING TORQUES-Fasteners—See Page 2.

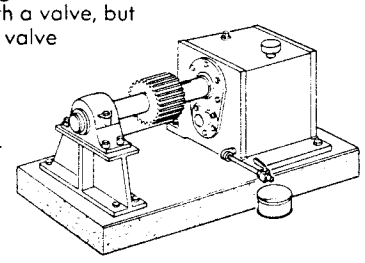
GREASE LUBRICATED BEARINGS—See Page 3.

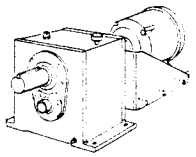
STORED AND INACTIVE UNITS—See Page 4.

MOUNT HORIZONTALLY—CAUTION: Mount unit with base horizontal, unless it has been specifically ordered for mounting in another position. If it is necessary to mount the unit in a different position from that for which it was ordered, consult The Falk Corporation for changes necessary to provide proper lubrication.

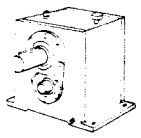
FOUNDATION, GENERAL—To facilitate oil drainage, elevate the unit foundation above the surrounding floor level as illustrated. If desired, replace the unit oil drain plug with a valve, but provide a guard to protect the valve from accidental breakage.

When an outboard bearing is used, mount unit and outboard bearing on a continuous foundation or bedplate and dowel both in place.





FZ



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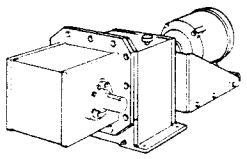
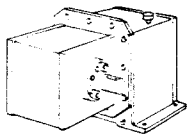
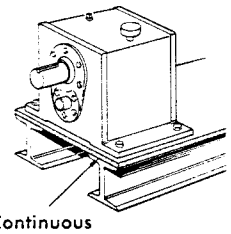


FZB



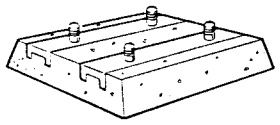
FCB

FOUNDATION, STEEL—When mounting unit on structural steel, it is recommended that an engineered design be utilized for a baseplate or bed to provide sufficient rigidity, to prevent induced loads from distorting the housing and causing gear misalignment. In the absence of an engineered design, it is recommended that a baseplate, with thickness equal to or greater than the thickness of the unit feet, be securely bolted to steel supports and extend under the entire unit as illustrated.



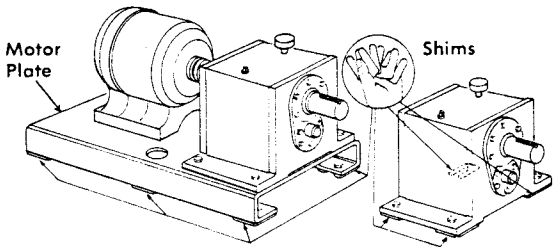
Continuous Plate

FOUNDATION, CONCRETE—If a concrete foundation is used, allow the concrete to set firmly before bolting down the unit. For the best type of mounting, grout structural steel mounting pads into the mounting base, as illustrated, rather than grouting the unit directly into the concrete.



Motors and other components (whether mounted on motor plates or motor brackets) may become misaligned during shipment. ALWAYS check alignment after installation. Refer to Page 2 for coupling alignment instructions.

UNIT ALIGNMENT—Align unit with driven equipment by placing broad, flat shims under all mounting pads. Start at the low speed shaft side and level across the length and then the width of the unit. Check with a feeler gauge to make certain that all pads are supported to prevent distortion of housing when unit is bolted down. After unit is aligned with driven machine and bolted down, align prime mover to unit input shaft. See Page 2 for coupling alignment.



If equipment is received from Falk mounted on a bedplate, the components were accurately aligned at Falk with the bedplate mounted on a large, flat assembly plate. Shim under the bedplate foot pads until the bedplate is level and all feet are in the same plane.

Check the high speed shaft coupling alignment. If the coupling is misaligned, the bedplate is shimmed incorrectly. Re-shim bedplate and re-check high speed coupling alignment. If necessary, realign motor.

TABLE 5 GEAR NUT TIGHTENING TORQUE (lb-in.) AT HIGH SPEED SHAFT

AGMA Ratio	UNIT SIZE							
	1060	1070	1080	1090	1100	1110	1120	1130
High Speed Gear on Ref. #3 Shaft Assembly, Figure 2								
38.44	625	870	1070	1660	2050	2585	3265	3860
47.08	520	700	880	1385	2050	2585	2655	3145
57.66	415	580	720	1140	1385	2130	2240	2650
70.62	345	460	585	935	1385	1400	1820	2155
86.50	275	380	475	935	1125	1400	1435	2155
105.9	230	325	385	935	1125	1150	1185	1400
129.7	185	255	385	615	735	1150	985	1400
158.9	155	220	385	500	735	940	985	1165
194.6	155	220	385	500	735	940	985	1165
High Speed Gear on Ref. #2 Shaft Assembly, Figure 2								
238.4	165	190	220	310	470	585	845	890
291.9	135	155	180	310	375	585	700	735
357.5	90	100	145	255	310	480	570	600
437.9	90	100	145	205	265	390	465	490
536.3	50	100	145	205	265	315	375	395
656.8	50	60	80	170	205	260	305	320
804.5	50	60	80	115	205	260	305	320
985.3	50	60	80	115	205	260	305	320
1207	50	60	80	115	205	260	305	320
Intermediate Gear on Ref. #3 Shaft Assembly, Figure 2								
238.4	100	140	175	225	405	420	530	625
291.9	80	110	140	225	325	420	435	515
357.5	55	75	115	185	265	345	355	420
437.9	55	75	115	150	225	280	290	340
536.3	30	75	115	150	225	225	235	275
656.8	30	40	65	120	180	185	190	225
804.5	30	40	65	85	180	150	160	225
985.3	30	40	65	85	115	185	190	225
1207	30	40	65	85	115	150	160	185
High Speed Gear on Ref. #4 Shaft Assembly, Figure 2								
1.5	2645	3450	5350	5215	....	....	.....	.....
1.84	2235	2880	4430	4350	....	....	.....	.....
2.25	1785	2340	3630	3475	....	....	.....	.....
2.76	1450	1915	2990	2845	....	....	.....	.....
3.38	1205	1580	2435	2290	....	....	.....	.....
4.13	990	1300	2055	1885	....	....	.....	.....
5.06	2235	2880	4430	5215	7795	8210	10260	10655
6.20	1785	2340	3630	4350	6160	6710	8445	8560
7.59	1450	1915	2990	3475	5175	5375	6935	7035
9.30	1205	1580	2435	2845	4290	4305	5705	5925
11.39	990	1300	2055	2290	3415	3550	4620	4555
13.95	815	1065	1670	1885	2820	2920	3810	3745
17.09	650	830	1315	1570	2285	2395	3070	3150
20.93	520	700	1090	1280	1830	1985	2525	2540
25.63	430	575	905	1025	1565	1575	2035	2090
31.39	350	465	740	860	1220	1320	1655	1740
Intermediate Gear on Ref. #4 Shaft Assembly, Figure 2								
38.44	285	380	590	685	1020	1070	1375	1380
47.08	235	305	485	570	815	885	1120	1125
57.66	190	255	395	470	690	730	945	950
70.62	155	200	320	385	550	580	765	770
86.50	125	165	260	310	450	480	605	635
105.9	105	140	210	260	380	395	500	500
129.7	85	110	175	205	290	310	415	410
158.9	70	95	145	165	250	255	335	340
194.6	60	80	120	140	195	215	270	285
238.4	45	60	95	115	160	175	220	225
291.9	35	50	80	90	130	145	185	185
357.5	30	40	65	75	105	120	150	150
437.9	25	30	50	60	90	95	120	120
536.3	20	25	45	50	75	80	100	100
656.8	17	20	35	40	60	65	80	80
804.5	13.8	18	30	35	50	50	65	65
985.3	11.4	15	25	30	40	40	50	55
1207	9.3	12.1	20	25	30	35	45	45

TABLE 6 HIGH SPEED SHAFT KEYLESS BORED PINIONS AND NON-REMOVABLE BEARINGS

Reduction	AGMA Ratio	UNIT SIZE							
		1060	1070	1080	1090	1100	1110	1120	1130
Triple (F3)	**38.44**	Keyless†	Keyless†	.....	....	.....	.....	.....	.....
	47.08	Keyless†	Keyless†	.....	....	.....	.....	.....	.....
	57.66	Keyless†	Keyless†	.....	....	.....	.....	.....	.....
	70.62	Keyless†	Keyless†	.....	....	.....	.....	.....	.....
	86.50	Keyless†	Keyless†	.....	....	.....	.....	.....	.....
Quadruple (F4)	**238.4**	Keyless†	Keyless†	Keyless†	....	Keyless	Keyless	Keyless	Keyless
	291.9	Keyless†	Keyless†	Keyless†	....	Keyless	Keyless	Keyless	Keyless
	357.5	Keyless†	Keyless†	Keyless†	....	Keyless	Keyless	Keyless	Keyless
	437.9	Keyless†	Keyless†	Keyless†	....	.....	Keyless	Keyless	Keyless
	536.3	.....	Keyless†	Keyless†	....	.....	.....	.....	.....

† The outer bearing of the shaft assembly is not removable.

HIGH SPEED HEAD ASSEMBLY

33. DOUBLE REDUCTION — SIZES 1060 THRU 1130F2.

A. For high speed shafts with pinion on shaft and with:

1. Ball bearings, simply slide the assembly into the high speed head. Mount the retaining ring on outer bearing and inner bearing if so equipped.
2. Tapered roller bearings, insert the inner bearing outer race into inner wall of high speed head. Then insert the high speed shaft assembly and outer bearing outer race.

B. For high speed shaft with unmounted pinion, follow preceding Step 1 or 2. Mount the bored pinion per Steps 17B and 17C.

C. For Size 1060 and 1070 units, install seal and seal cage with one .031" shim-gasket as outlined in Steps 8D thru 8J.

D. For Size 1080 thru 1130 units:

1. Mount seal cage (without seal) with a total of at least .062" of shim-gaskets.
2. Insert seal cage fasteners, torque to Table 2 values.
3. Adjust high speed shaft axial float per Step 22 and Table 3. Use only one .015" shim-gasket in the final shim pack. On Sizes 1080 and 1090, place the .015" shim-gasket against the seal cage. On Sizes 1100 thru 1130, place the .015" shim-gasket against the unit housing.
4. Remove seal cage and install seal as outlined in Steps 8D thru 8J and 8L. Tighten fasteners to torque shown in Table 2.

TRIPLE REDUCTION — SIZES 1060 THRU 1130F3.

34. SIZES 1060 THRU 1080F3.

A. Insert high speed shaft assembly through the outer wall and into the inner wall of the high speed head.

B. Install seal and seal cage with one .015" shim-gasket as outlined in Steps 8D through 8J. Tighten fasteners to torque shown in Table 2.

C. Dip the gear lock nut in SAE 20 or heavier oil.

D. See Figure 2. With the intermediate pinion and the adjacent bearing minus the bearing outer race retaining ring in place on intermediate #3 shaft (and key in taper), insert the shaft through (1) the inner wall of the high speed head, (2) bearing retaining ring, (3) taper-bored gear (and spacer for Size 1060), (4) lock nut (turn finger tight), (5) spacer, (6) and into the outer high speed head bearing bore.

E. Mount retaining ring on inner bearing.

F. Tap the outer bearing into the bore and onto the shaft. Temporarily mount spacer (1070 and 1080) and end cover with two or three fasteners to hold shaft in place.

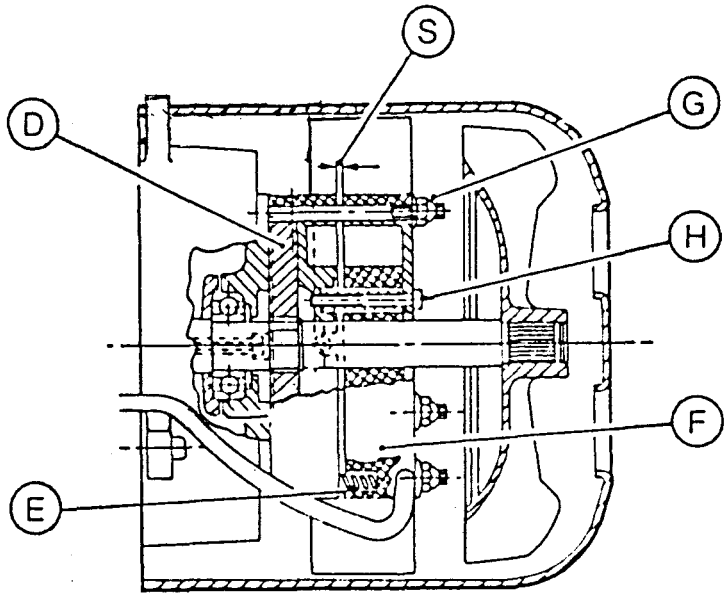
G. Tighten lock nut per Step 23.

H. Remove end cover and seat inner race of the outer bearing. Insert bearing spacer (1070 and 1080). Mount end cover with one .031" shim-gasket and tighten fasteners to torque shown in Table 2.

MAINTENANCE

TYPE 734 DISC BRAKE

These brakes have their brake torque pre-set at our factory and require no initial inspection. Periodic examination of all brakes to determine wear will ensure efficient operation.



● MAINTENANCE

The only maintenance required is to periodically check the air gap(s) (S) and when this reaches 0.024" the brake should be re-adjusted to the initial air gap of 0.008".
A maximum of four adjustments can be made during the life of the brake.

● AIR GAP ADJUSTMENT

The method of adjustment is to fully close the air gap and then slightly unscrew the fixing nuts in order to re-set the gap to the correct value. The following method should be used.

1. Remove fan and fan cover.
2. Tighten brake fixing lock nuts (G) to a torque of 4lb.in. If new Simmonds nuts are used these should be screwed down the thread forwards and backwards before setting to the torque figures given.
3. When all nuts (G) have been tightened to the stated torque, each one is then turned anti-clockwise 135°. This will ensure an airgap of 0.008". Alternatively feeler gauges can be used to set the air gap.

● DISC REPLACEMENT

4. Fit 2 transporter screws (H) and fully tighten the screws.

   Screw:– M5 x 55.
5. Remove Simmonds nuts and washers.
6. Remove coil units/armature (F).
7. Remove push off springs (E).
8. Remove friction disc (D).
9. Thoroughly clean the brakes, taking care not to damage the pole faces and re-assemble as follows:–

● RE-ASSEMBLY

10. Fit friction disc (D) onto square hub on shaft.
11. Fit the 6 push off springs (E) into blind holes in spacing ring.
12. Fit coil unit/armature (F).
13. Adjust to correct airgap setting as in 2 and 3 above.
14. Remove transporter screws (H).
15. Re-fit fan and fan cover.

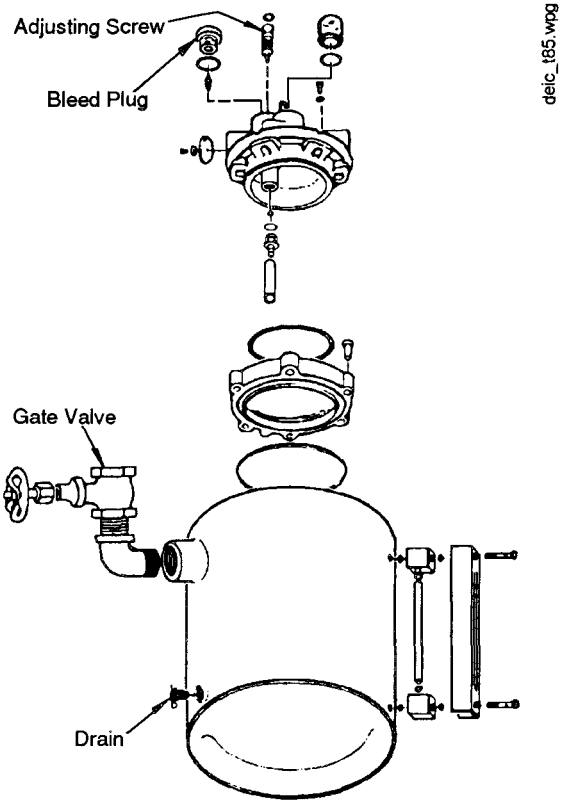
5.2 COMPRESSED AIR SUPPLY

SYSTEM PRESSURE REGULATOR

An adjustable regulator in the compressor receiver outlet line keeps the system air pressure at 120 PSI. This system pressure is visually displayed on the pressure gauge on the regulator. See the article on pressure regulators further along in this section.

DEICER

This component, located just downstream from the air receiver and next to the in-line filter, injects a chemical into the compressed air system to prevent component freeze-up in cold weather. The rate of delivery to the air system is controlled by the *ADJUSTING SCREW* on top of the unit. Turning it counterclockwise (CCW) increases flow, and clockwise (CW) decreases it. Be sure to adjust the flow rate only when there is air movement through it. The de-icer delivers all the desiccant downstream that passes through its sight dome. Delivery rate automatically changes with varying air flow rates through the de-icer once set. Adjust the flow rate for normal usage so a steady drip is observed in the sight dome.



Disclaimer:

The use of any desiccant other than Tannergas in a Tanner De-Icer voids its warranty.

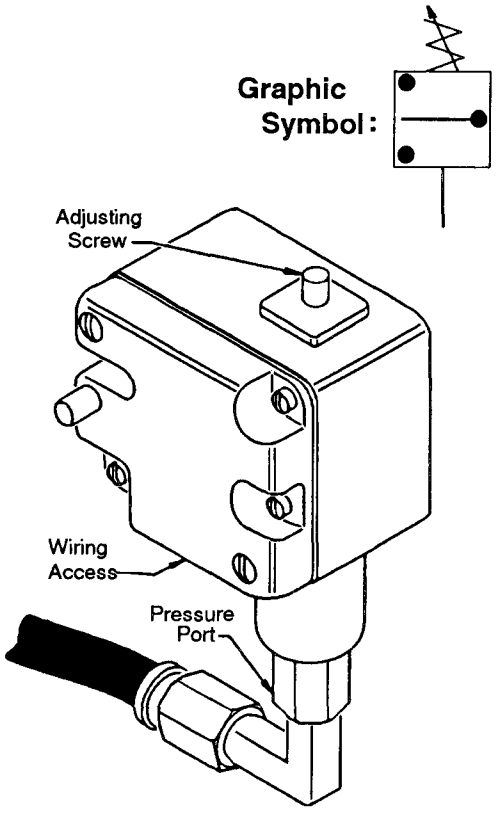
The fluid level in the de-icer should be checked once per shift in cold weather when in use. Keep it full. To fill the de-icer, slowly unscrew *BUT DO NOT REMOVE* the *BLEED PLUG* at the top of the deicer to vent the air pressure in the deicer.

CAUTION **THE DEICER IS UNDER PRESSURE. Loosen the bleed plug until the air pressure is vented completely. DO NOT REMOVE THE BLEED PLUG.**

SLOWLY open the *GATE VALVE* and add desiccant as determined by the sight gauge on the side of the tank. Close the gate valve and the bleed plug. The de-icer used on this machine has a 2 U.S. gallon (7.6 liter) capacity bowl. Drain off any contaminants which collect in the bottom of the bowl using its drain cock.

AIR PRESSURE SWITCHES

These devices are used in the air receiver supply line and in the swing, crowd, hoist, and propel brakes circuits to monitor system pressure and brake operation. These switches are all double-make double-break units that have snap action switching elements. They automatically reset by a snap-action of the switch. *DO NOT PLUG THE DRAIN PORT ON THESE UNITS.* Each switch is adjustable externally within the ranges listed on it. Refer to the air system schematic for the setting on each pressure switch.



If the air pressure in any of these circuits falls below a preset value on its pressure switch, then an electrical interlock will be activated that will alert the operator of the malfunction and, in some instances, shutdown the machine.

A pressure switch in the auto lube air supply circuit monitors that system for pressure in excess of a preset amount. If this pressure is exceeded, then the operator is again notified of the situation via the annunciator panel.

AIR CARE
SEMINAR TRAINING

Sullair Air Care Seminars are 3–day courses that provide hands–on instruction in the proper operation, maintenance and service of Sullair equipment. Individual seminars on Industrial compressors and compressor electrical systems are presented at regular intervals throughout the year at a dedicated training facility at Sullair's corporate headquarters in Michigan City, Indiana.

Instruction includes discussion of the function and installation of Sullair service parts, troubleshooting of the most common problems, and actual equipment operation. The seminars are recommended for maintenance and service personnel.

For detailed course outlines, schedule and cost information contact:

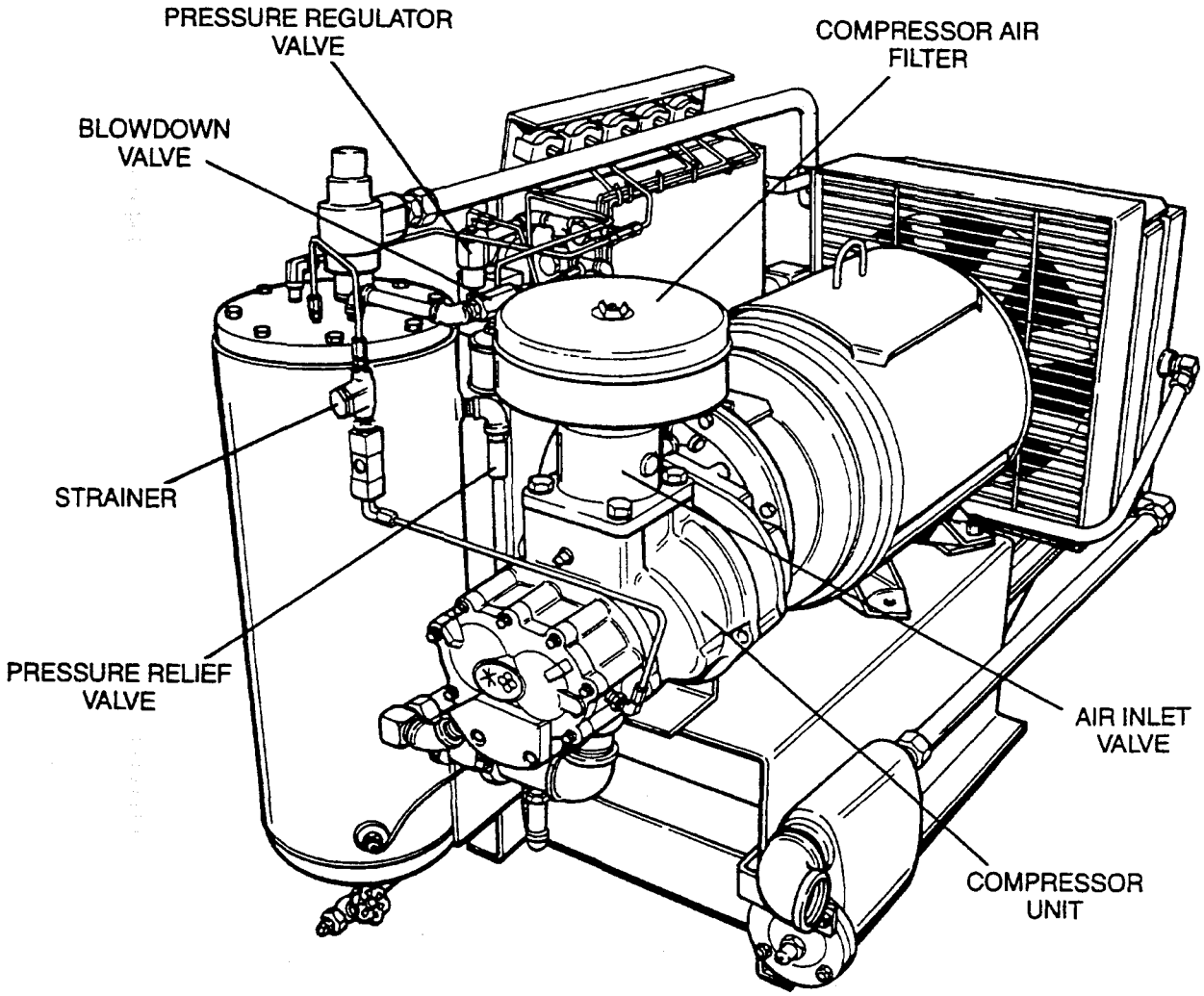
Sullair Corporate Training Department
1–800–SULLAIR or 219–879–5451 (ext. 1816)

– Or Write –

Sullair Corporation
3700 E. Michigan Blvd.
Michigan City, IN 46360
Attn: Service Training Department

Section 2
DESCRIPTION

Figure 2–2 Sullair LS–10 Series Rotary Screw Compressor



fluid is piped into the four–pass heat exchanger where compression heat is removed from the fluid.

The "open" design of the LS–10 Series air compressor, (whether air–cooled or water–cooled), provides easy access to all components.

2.3 SULLAIR COMPRESSOR UNIT, FUNCTIONAL DESCRIPTION

Sullair air compressors feature the rotary screw, a single–stage, positive displacement, lubricated–type compressor. This unit provides continuous (pulse–free) compression to meet your needs.

NOTE

With a Sullair compressor, there is no maintenance or internal inspection of the compressor unit required.

Fluid is injected into the compressor unit in large quantities where it mixes directly with the air as the rotors turn, compressing the air. The fluid flow has three basic functions:

1. As coolant, it controls the rise of air temperature normally associated with the heat of compression.
2. It seals the leakage paths between the rotors and the stator and also between the rotors themselves.
3. It acts as a lubricating film between the rotors allowing one rotor to directly drive the other, which is an idler.

After the air/fluid mixture is discharged from the compressor unit, the fluid is separated from the air. At this time, the air flows through an aftercooler and separator then to your service line while the fluid is being cooled in preparation for reinjection.

NOTES

Section 6
MAINTENANCE

The pressure must not exceed the maximum operating pressure which is stamped on the compressor serial number nameplate. The following explanation applies to a typical installation with a desired operating range of 115 to 125 psig (7.9 to 8.6 bar). This information will apply to a compressor with any other operating range excepting the stated pressures.

Remove the cover of the pressure switch, pressure regulator and inlet valve as required. With the shut–off valve closed (or slightly cracked open) start the compressor. Observe the line pressure gauge and pressure switch contacts. When the line pressure reaches 125 psig (8.6 bar), the pressure switch contacts should open. If the pressure switch contacts do not open or they open prior to the desired pressure, the pressure switch setting will require adjustment (refer to Figure 6–5).

FOR PRESSURE RANGE ADJUSTMENT:

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 equally.

FOR DIFFERENTIAL ADJUSTMENT:

Differential is the difference between the high and low pressure settings. 10 psig (0.7 bar) is typical.

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.
2. When the pressure switch adjustment is complete, the pressure regulator should be adjusted for the pressure at which modulation of air delivery should begin. In this case that pressure will be 118 psig (8.2 bar). The regulator is adjusted by loosening the jam nut on the end of the cone shaped cover of the pressure regulator. When the jam nut is loose, turn the adjusting screw clockwise to increase or counterclockwise to decrease the setting.
3. To set the regulator, continue closing the service valve, until the line pressure is 118 psig (8.2 bar). At this point regulator should pass a signal to the inlet valve to start closing it. If the line pressure keeps on rising or if the modulation does not begin, adjust the regulator valve as described above. After adjustment line pressure should be approximately 118 psig (8.2 bar) and 1.00 in. Hg vacuum below the inlet.
4. Now close the service valve, line pressure will start rising. When line pressure reaches 125 lbs., the inlet valve will be closed to its maximum position. The inlet vacuum at this point will be around 25 in. Hg. The machine should unload at this point.
5. Open the service valve so the line pressure is 115 psig (7.9 bar). Machine is now set for operation. Recheck the unload pressure by closing of the service valve. Machine should unload via the pressure switch at 125 psig (8.6 bar).

After the control pressures have been adjusted, the "unloaded" sump pressure should be checked. It will be necessary to shut the compressor down, remove the pressure switch cover and disconnect one of the two lead wires that are connected to the micro–switch (contact block). After disconnecting the lead, tape the exposed wire with electrician's tape to make sure that it does not come in contact with any metallic surface.

⚠ DANGER

DO NOT touch the electrical contacts, terminal or leads with any metallic object. Severe electrical shock may occur.

With the lead taped, you may start the compressor again. Allow the sump pressure to stabilize.

The sump pressure should read 30 to 35 psig (2.1 to 2.8 bar).

Once this is checked, shut the compressor down once again and reconnect the taped lead and replace the pressure switch cover. At this time, start the compressor and cycle the Control System several times and re–check all pressure settings and adjustments.

⚠ DANGER

DO NOT touch the pressure switch, electrical contacts, terminal board or leads with any part of the body or any uninsulated metallic object. Severe electrical shock may occur.

Cycle the Control System several times and recheck all pressure settings.

6.7 TROUBLESHOOTING

The information contained in the Troubleshooting chart is based upon both the reports about actual field applications, and extensive testing done at the factory. It contains symptoms and usual causes for the described problems. However **DO NOT** assume that these are the only problems that may occur. All available data concerning the trouble should be systematically analyzed before undertaking any repairs or component replacement procedures.

A detailed visual inspection is worth performing for almost all problems. Doing so can prevent unnecessary damage. Always remember to:

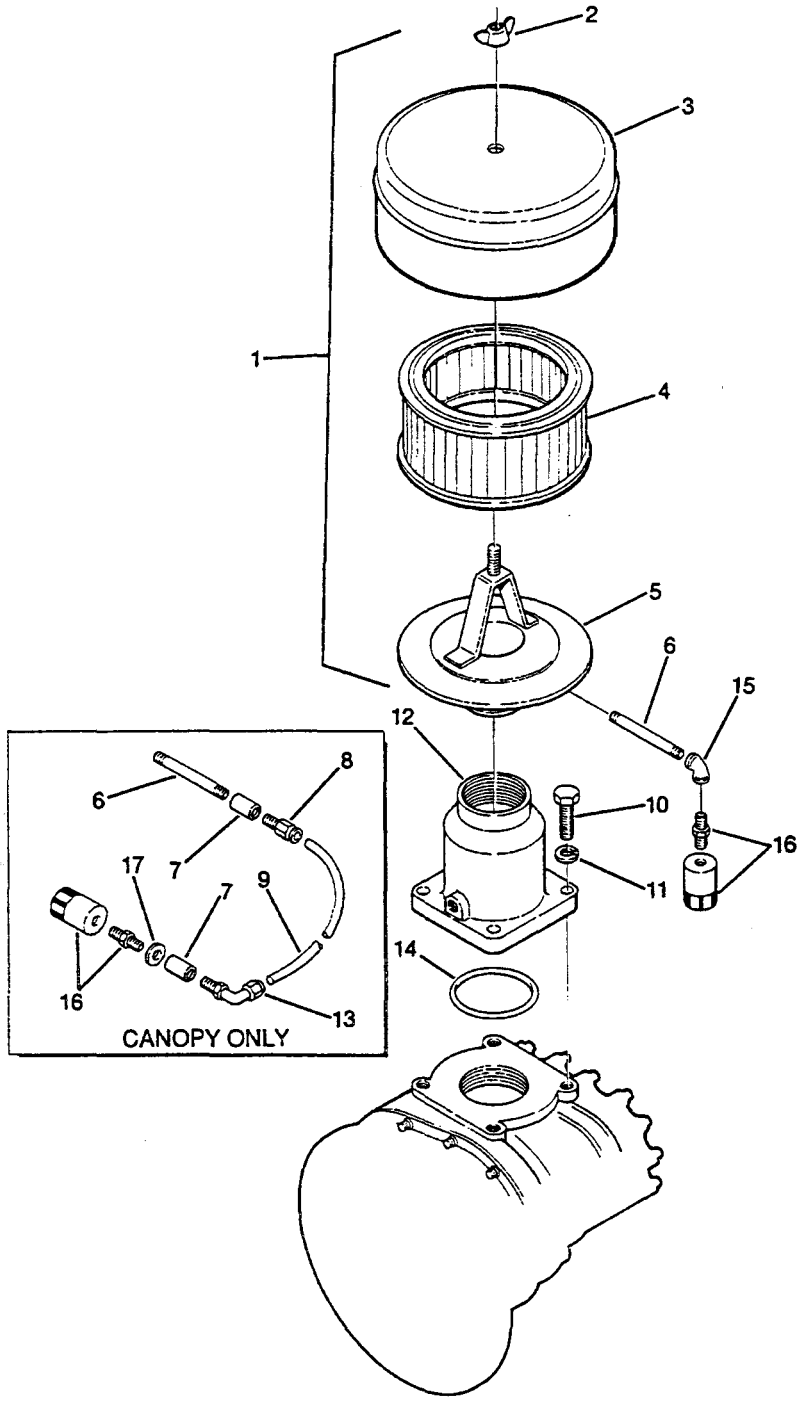
a. Check for loose wiring.
b. Check for damaged piping.
c. Check for parts damaged by heat or an electrical short circuit, usually apparent by discoloration or a burnt order.

Should your problem persist after making the recommended check, consult your nearest Sullair representative or the Sullair Corporation factory.

Section 7

ILLUSTRATIONS AND PARTS LIST

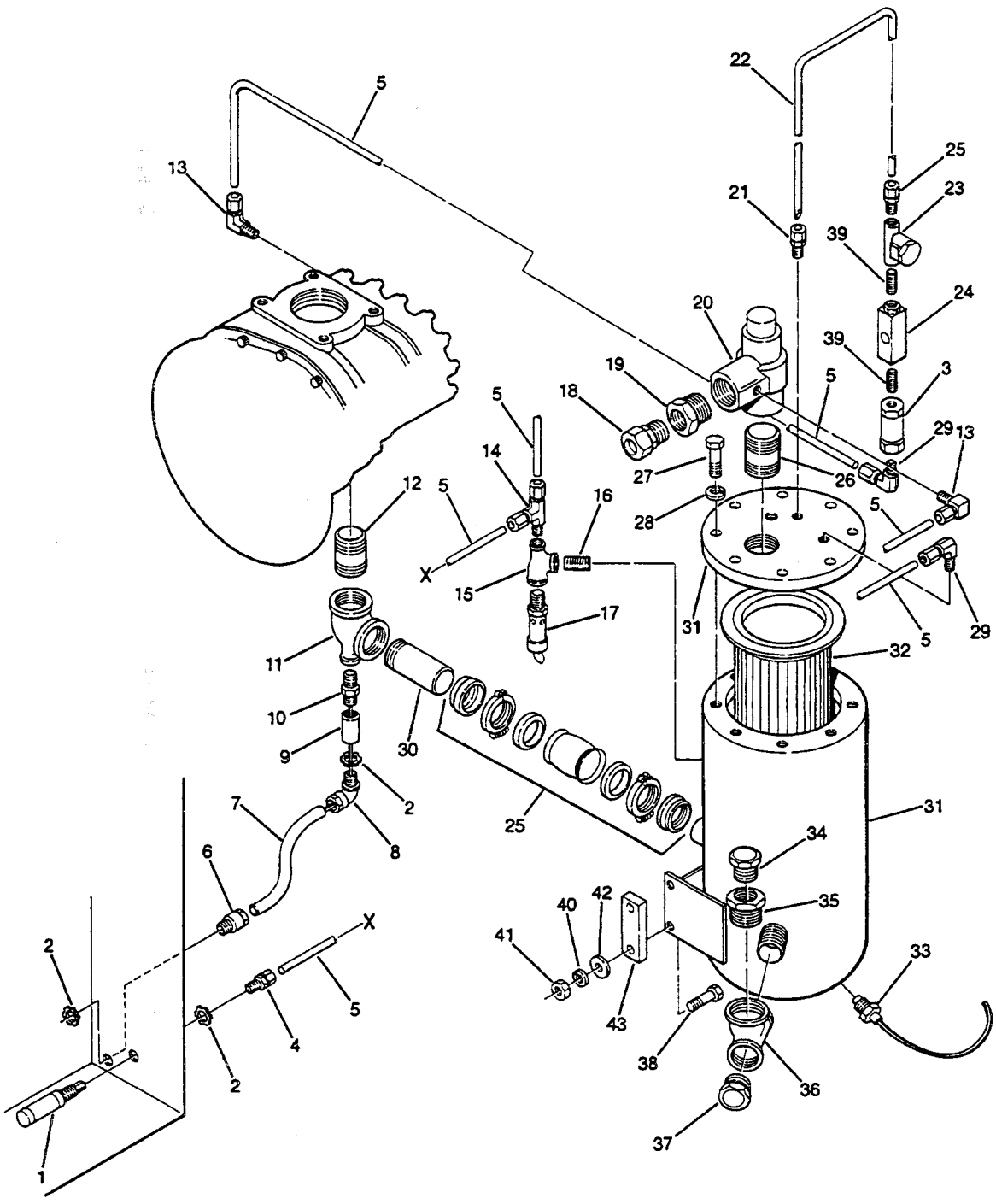
7.4 AIR INLET SYSTEM



Section 7

ILLUSTRATIONS AND PARTS LIST

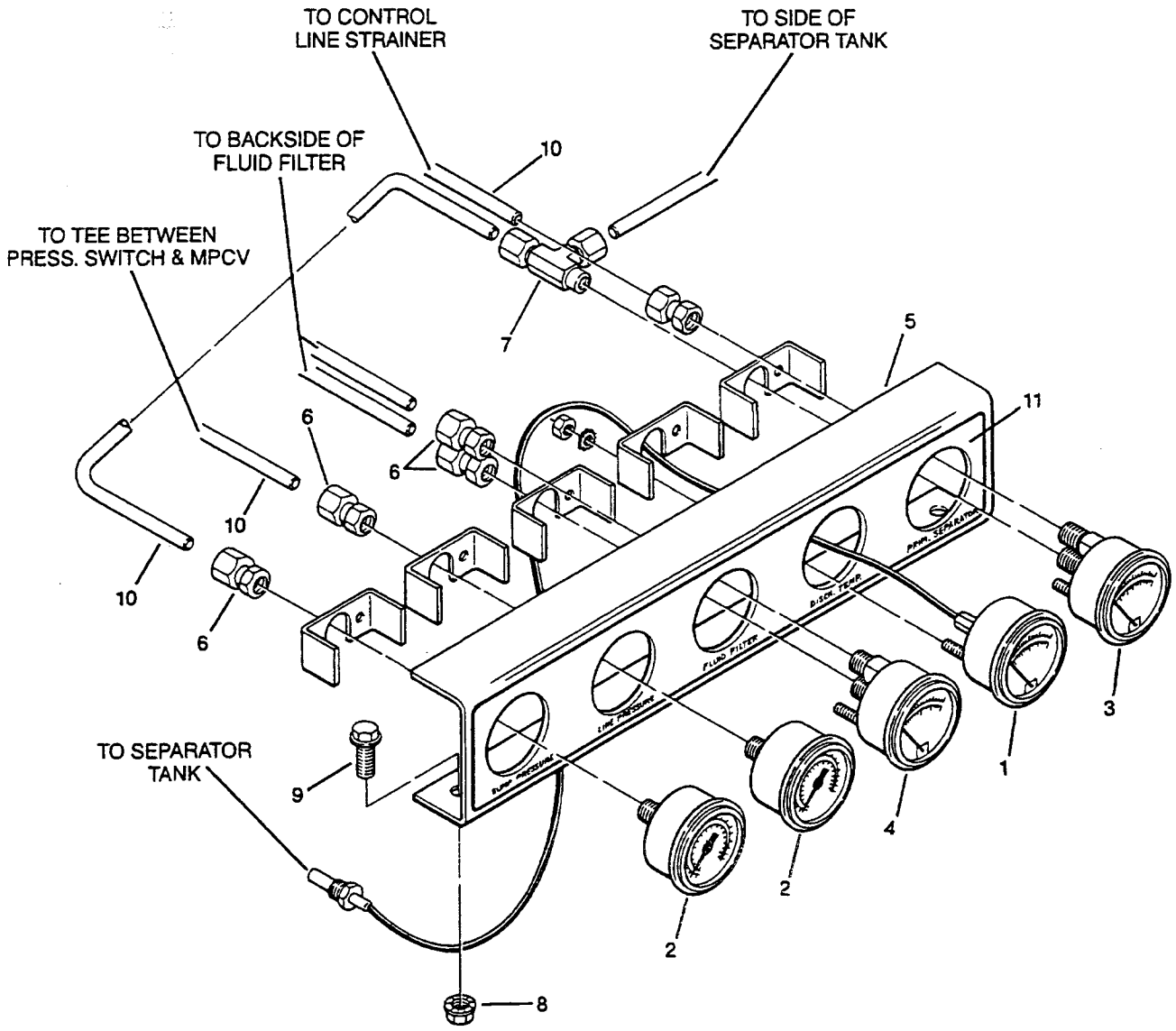
7.8 COMPRESSOR DISCHARGE SYSTEM



Section 7

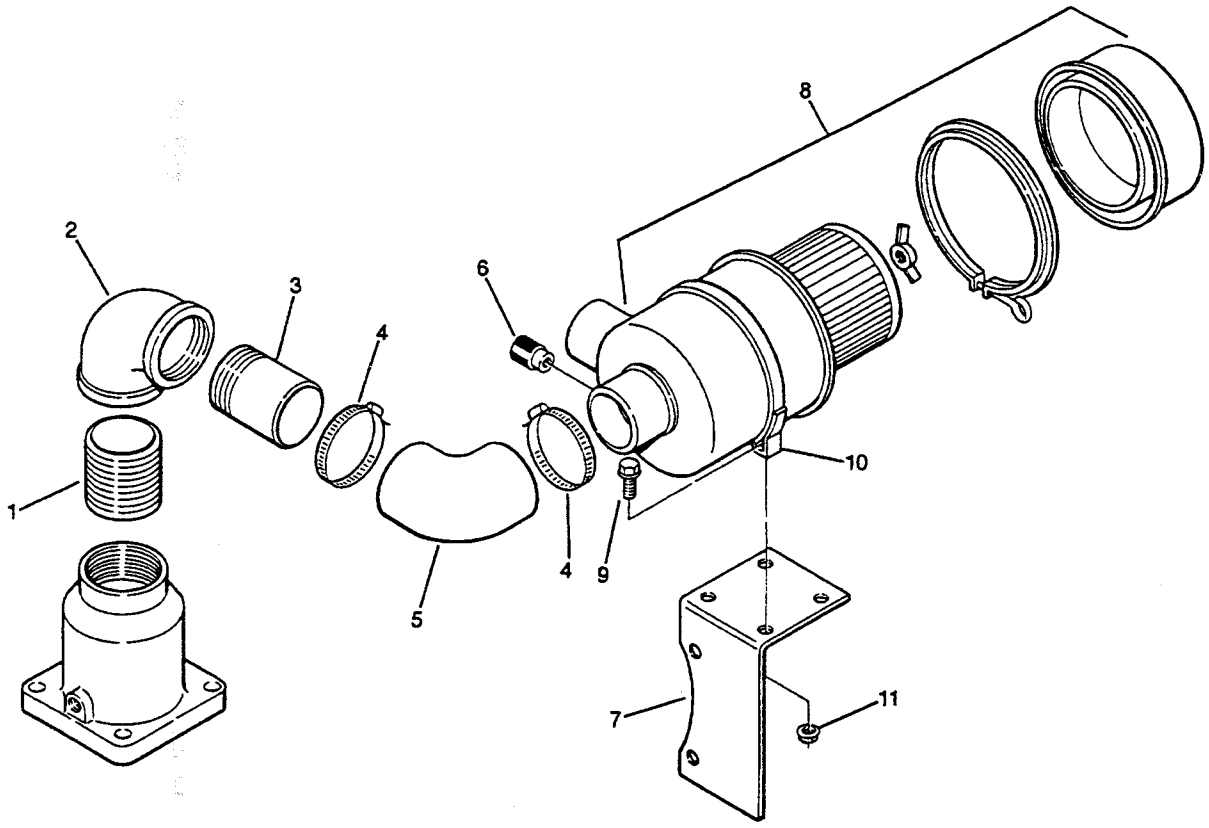
ILLUSTRATIONS AND PARTS LIST

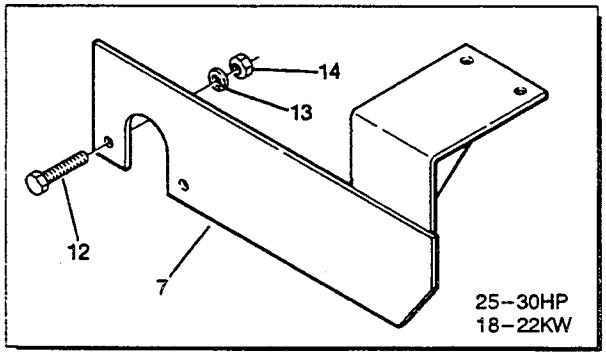
7.11 INSTRUMENT PANEL – OPEN AND ENCLOSURE OPTION



ILLUSTRATIONS AND PARTS LIST

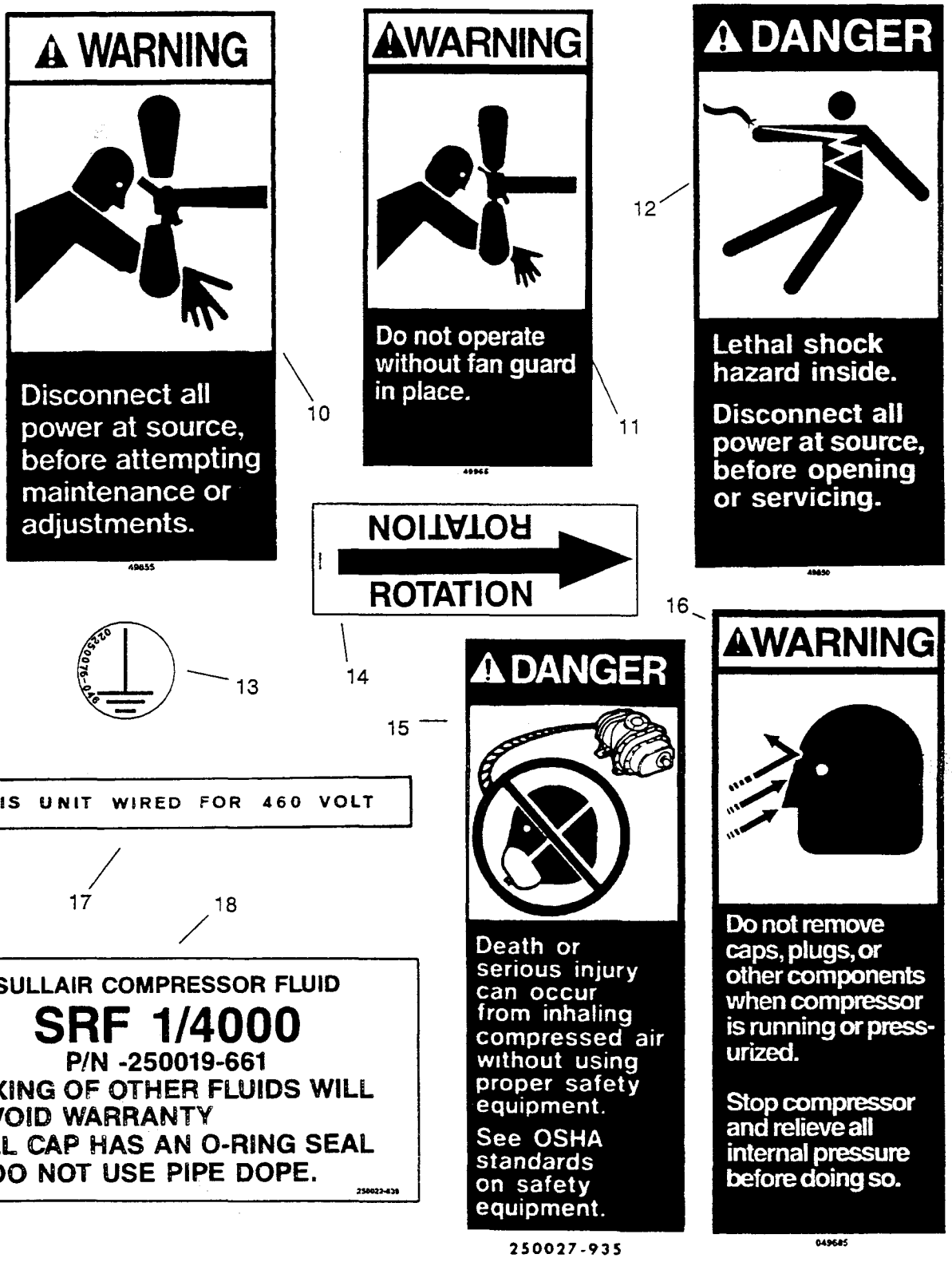
7.16 HEAVY DUTY FILTER OPTION





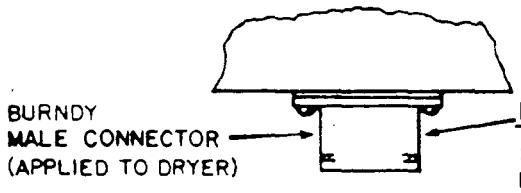
ILLUSTRATIONS AND PARTS LIST

7.19 DECAL GROUP



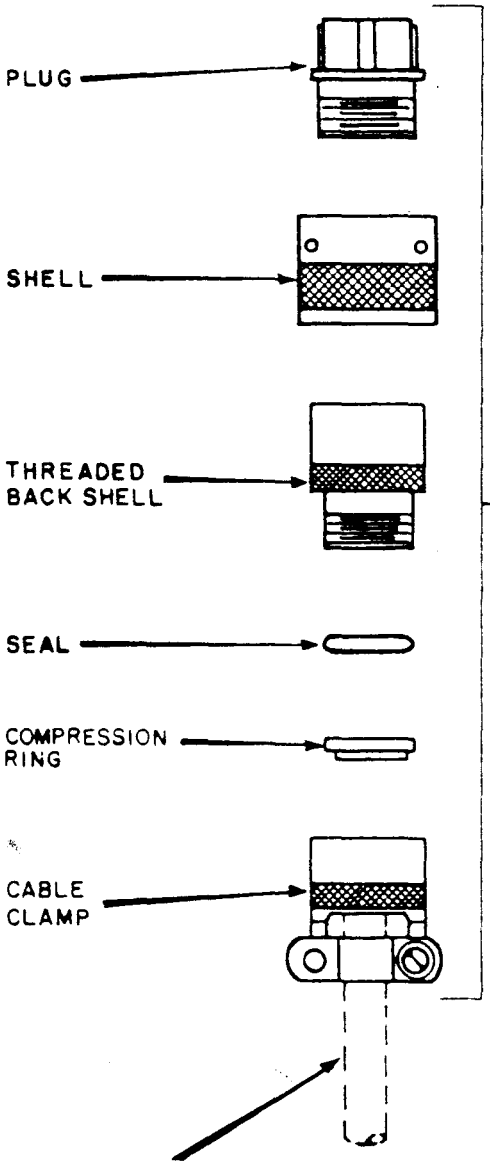
No. 975-100 SERIES
WIRING SCHEMATIC

No. 975-100 SERIES
ELECTRICAL HOUSING



MALE CONNECTOR

SALEM NO. 5247-050
BURNDY NO. BT02A12-3P-E



FEMALE CONNECTOR

SALEM NO. 5247-005
BURNDY NO. BT06JF12-35

CABLE TO BE PROVIDED
BY CUSTOMER

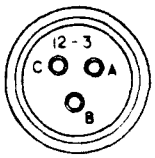
(RECOMMENDED CABLE SIZE
No. 16 – 3)

CONNECTION DETAILS

IMPORTANT: This is a polarized circuit. A continuous positive (+) power source must be connected to socket (A) of Burndy plug. An intermittent positive (+) power source must be connected to socket (B) of Burndy plug. (SOURCE TO BE ESTABLISHED)

Graham-White will provide customer items shown at left. Customer is to provide a No. 16-3 conductor cable and make connection to Burndy female connector plug, making certain that + (continuous) line is to connection A, + (intermittent) line is to connection B and - is to connection C from power supply (see inside view of Burndy female connector plug below). Assemble female connector as shown at left. When dryer is ready for operation, connect female connector assembly to male connector.

INSIDE VIEW OF BURNDY
FEMALE CONNECTOR PLUG



NOTE –

CUSTOMER TO MAKE POWER CONNECTIONS TO A(+ CONTINUOUS), B(+ INTERMITTENT) AND C (–).

the SALEM Line

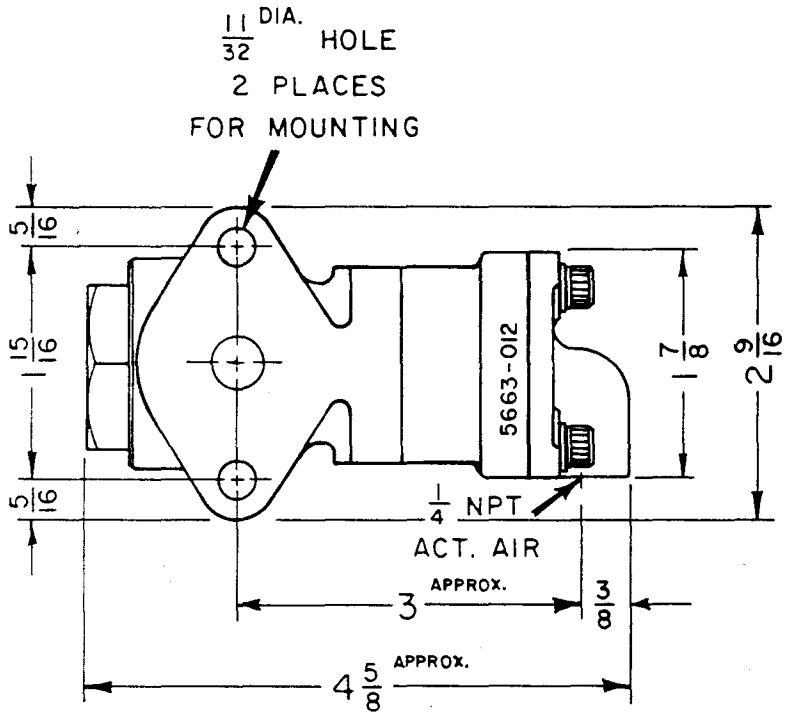
PURGE VALVE

No. 975-055

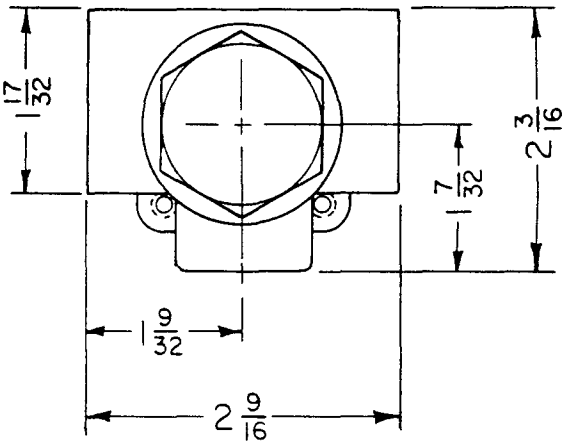
(SINGLE SEATED)

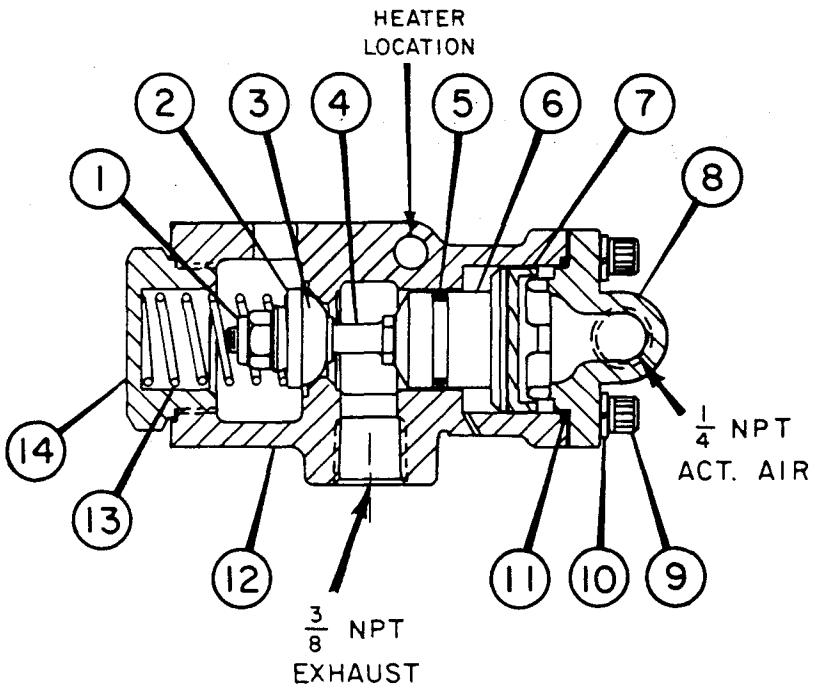
MAY 20, 1982

PARTS LIST			
ITEM	PART No.	DESCRIPTION	QTY.
1	1427-000	NUT	1
2	1313-001	SEAT WASHER	1
3	2745-000	SEAT	1
4	5639-010	STEM	1
5	1404-000	SEAL	1
6	5638-010	PISTON	1
7	5638-011	CUP SEAL	1
8	5636-001	CAP	1
9	1930-000	CAP SCREW	4
10	3154-028	LOCKWASHER (1/4")	4
11	5473-000	SEAL	1
12	5663-012	BODY	1
13	1314-000	SPRING	1
14	1316-000	CAP	1



NET WT.- 3 Lbs. Approx.





FOR REPAIR PARTS
ORDER KIT 75-010/-020

FOR MAINTENANCE AND REPAIR
SEE R & M 975-055

GRAHAM-WHITE SALES CORP.

the SALEM Line

1209 COLORADO STREET
SALEM, VIRGINIA 24153-1099

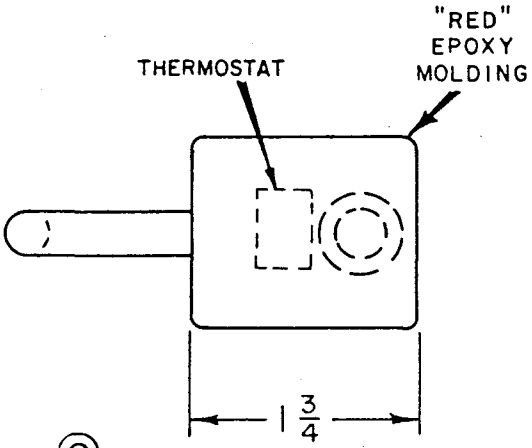
HEATER/THERMOSTAT ASSEMBLY

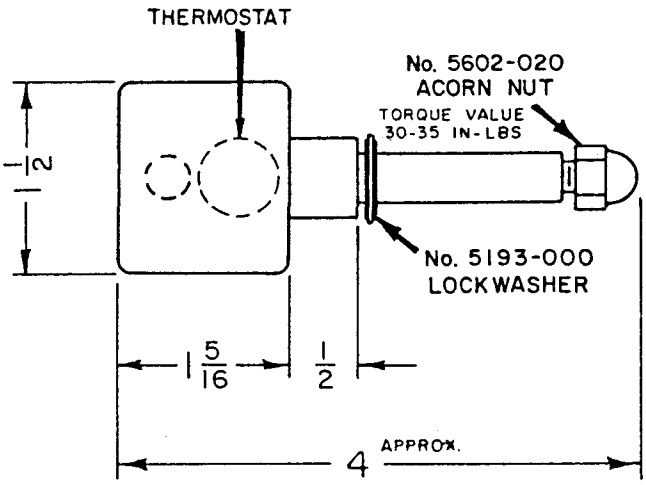
74 V. DC

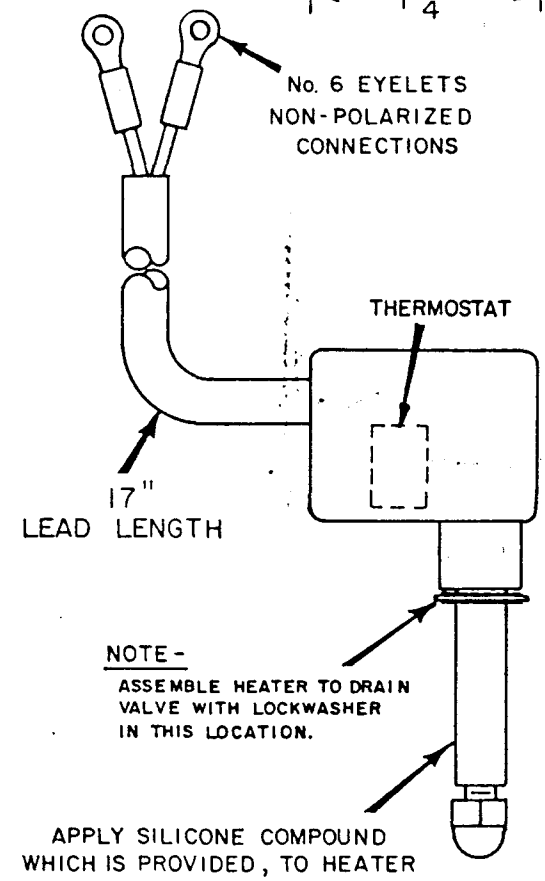
No. 5662-180

MARCH 12, 1986

SYM	DATE	REVISION
A	1-24-91	TORQUE VALUE ADDED..SP-422

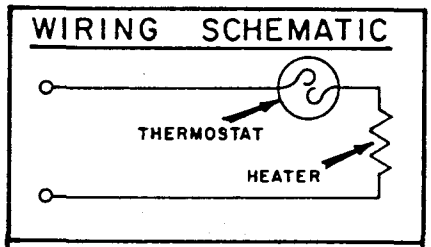






NET WT. - 6 ozs. Approx.

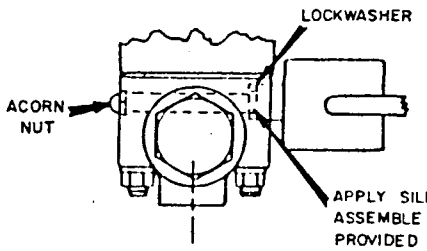
(ASSEMBLY WITH 17" LEAD)



ELECTRICAL DATA

74 VOLTS D. C.
35 WATTS

HEATER/THERMOSTAT AS APPLIED TO DRAIN/PURGE VALVE



THERMOSTAT -

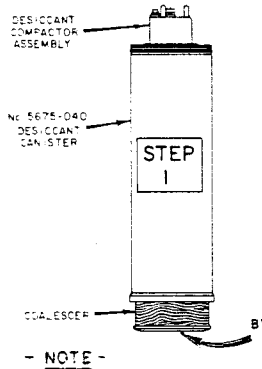
CLOSES - 36° F ± 3°
OPENS - 46° F ± 5°

GRAHAM-WHITE
the SALEM line
1209 COLORADO STREET
SALEM, VIRGINIA 24153-1099

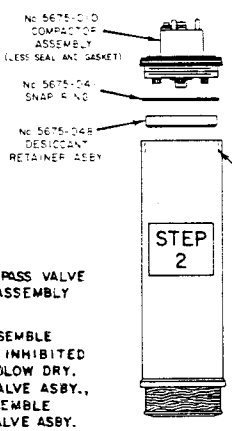
PROCEDURE FOR DESICCANT CHARGE RENEWAL

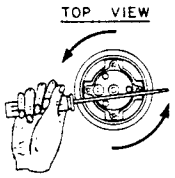
FOR CANISTER No. 5675-000 USED ON No. 975 SERIES

STEP 1 FIRST, PREPARE DESICCANT COMPACTOR ASSEMBLY FOR REMOVAL FROM DESICCANT CANISTER BY PROPERLY VENTING AIR FROM COMPACTOR. (PULL VENT STEM WHILE PUSHING INLET CHECK VALVE STEM, REFER TO PRINT No. 975 SERIES DESICCANT COMPACTOR OPERATION BACK SIDE.)



STEP 2 ROTATE DESICCANT COMPACTOR COUNTER-CLOCKWISE (IF NECESSARY, USE SCREWDRIVER BETWEEN LEGS ON TOP OF COMPACTOR, SEE TOP VIEW) AND REMOVE CAREFULLY, USING A SCREWDRIVER (SEE NOTE) REMOVE SNAP RING, AND THEN EXTRACT DESICCANT RETAINER.



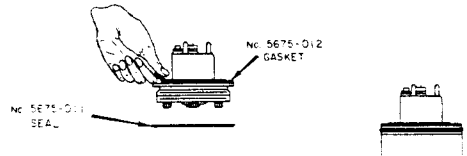


NOTE

WHILE REMOVING SNAP RING WITH SCREWDRIVER, BE CAREFUL NOT TO DAMAGE INTERNAL DIAMETER THREADS IN CANISTER.

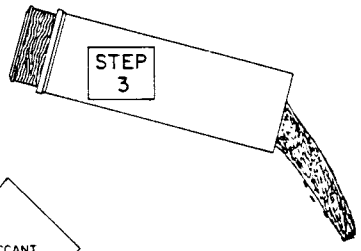
- NOTE -

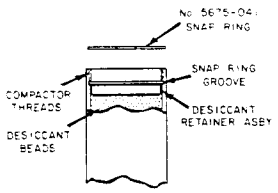
TO CLEAN COALESCER, DISASSEMBLE AND WASH COALESCER IN AN INHIBITED ALKALINE SOLUTION, THEN BLOW DRY. INSPECT SEAT IN BY-PASS VALVE ASSY., REPLACE IF DAMAGED. REASSEMBLE COALESCER AND BY-PASS VALVE ASSY. TO CANISTER.

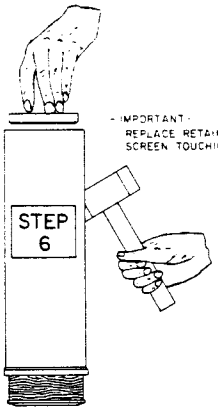


STEP 7 REMOVE GASKET FROM TOP OF COMPACTOR AND REPLACE WITH NEW No. 5675-012 GASKET. REPLACE SEAL No. 5675-011 AND MAKING CERTAIN THAT COMPACTOR PISTON IS FULLY RETRACTED, REPLACE COMPACTOR ASSEMBLY ON TOP OF RECHARGED DESICCANT CANISTER ASSEMBLY. ROTATE CLOCKWISE UNTIL THREADED SNUGGLY IN PLACE. - IMPORTANT - TIGHTEN HAND TIGHT ONLY.

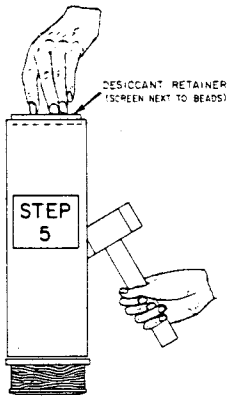
STEP 3 DISCARD OLD DESICCANT

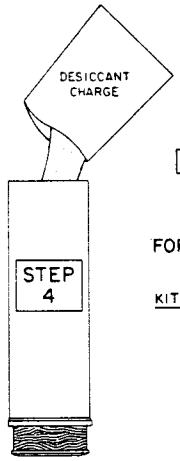






STEP 6 IMPORTANT - REMOVE DESICCANT RETAINER AND ADD MORE DESICCANT. REPLACE DESICCANT RETAINER AND CONTINUE TAPPING AND ROTATING PROCEDURE UNTIL TOP OF DESICCANT RETAINER LINES UP WITH BOTTOM EDGE OF SNAP RING GROOVE. CAREFULLY REPLACE SNAP RING INTO GROOVE ON TOP OF DESICCANT RETAINER BEING CAREFUL NOT TO DAMAGE COMPACTOR THREADS ON INSIDE DIAMETER OF CANISTER.





STEP 4 REFILL CANISTER WITH NEW DESICCANT No. 5675-042

FOR REFILL KIT ORDER:
KIT 75-012

KIT INCLUDES:

- No. 5675-011 SEAL
- No. 5675-012 GASKET
- No. 5675-042 DESICCANT CHARGE
- No. 5675-041 SNAP RING
- No. 1312-000 SEAT

STEP 5 PLACE DESICCANT RETAINER (WITH SCREEN NEXT TO DESICCANT BEADS) ON TOP OF DESICCANT CANISTER BEADS AND PUSH DOWN WHILE TAPPING LIGHTLY WITH A SOFT TIP HAMMER AND ROTATING CANISTER. TAP AND ROTATE UNTIL DESICCANT RETAINER DROPS BELOW SNAP RING GROOVE. GO ON TO STEP 6.

SYM.	DATE	REVISION

the SALEM Line

No. 5675-000 DESICCANT CANISTER ASSEMBLY REFILL PROCEDURE

DATE: 4-8-83

GRAHAM-WHITE SALES CORP.
1209 COLORADO STREET
SALEM, VIRGINIA 24153

SALEM SANDERS

No. 5675 REFILL PROCEDURE

OUTLET CHECK VALVE

R.&M. 975-265

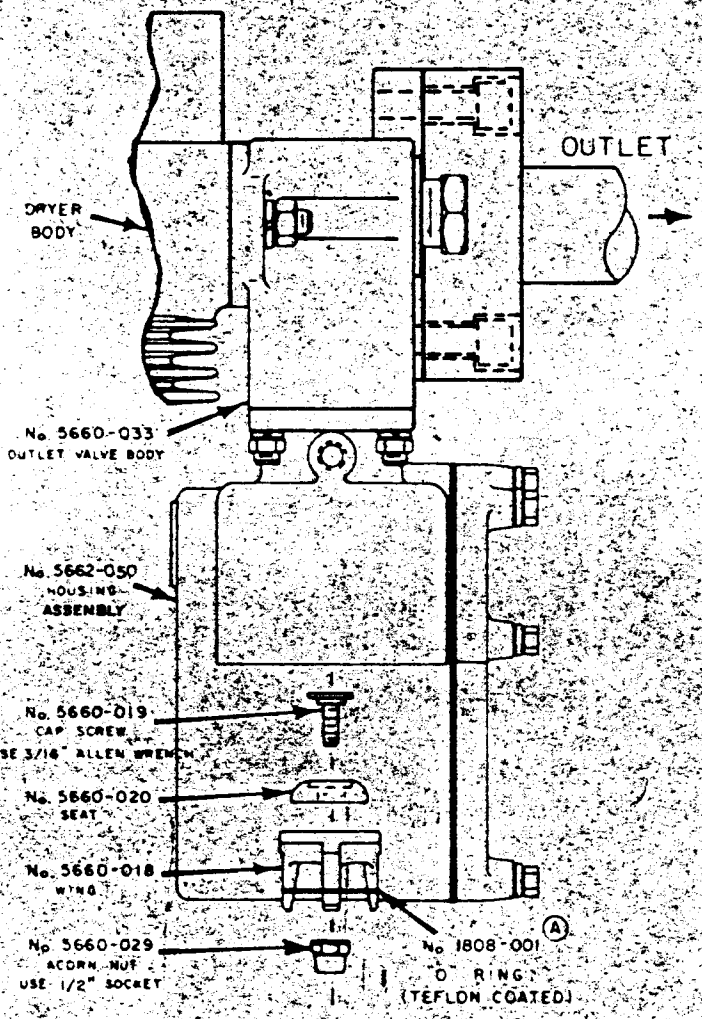
REPAIR AND MAINTENANCE

74 VOLTS D. C.
WITH MEMORY CIRCUIT

MARCH 15, 1984

SYM	DATE	REVISION
A	5-30-85	"O" RING PART NO. REVISED
B	11-29-90	SP-413

WARNING: This is a compressed air device. Compressed air is extremely dangerous if not handled carefully. DO NOT attempt to service, repair or break any connections without bleeding all air pressure from this device and all piping leading to or from it.



REMOVAL AND REPAIR PROCEDURE:

1. Using a 3/8" wrench, loosen four captive screws on solenoid assembly.
2. Wing valve assembly will drop down with solenoid assembly and spring.

IMPORTANT: An eyebolt has been provided on the bottom on the solenoid assembly to aid in disassembly if required.

3. Use a 1/2" socket to hold Acorn Nut No. 5660-029 and 3/16" Allen wrench to remove Seat No. 5660-020.
4. Reassemble new seat to wing.
5. Inspect o-ring No. 1808-001 and replace as required. Refer to back side for Solenoid Repair Procedure.

NOTE: For repair parts, order Kit 75-015.

SEE REVERSE SIDE FOR SOLENOID ASSEMBLY REPAIR AND MAINTENANCE

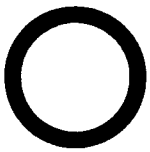
GRAHAM-WHITE SALES CORP.
1209 COLORADO STREET
SALEM, VIRGINIA 24153-1099

REPAIR KIT
FOR No. 5661-001/002 ORIFICE ASBY.
USED ON No. 975 SERIES

KIT 75-011

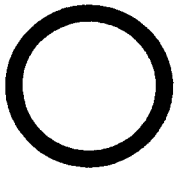
JANUARY 10, 1983

SEAL
No. 5661-020



SEAL
No. 1309-000

NOTE -
FOR MAINTENANCE PROCEDURE
REFER TO PRINT R&M 975-050
OR R&M 975-100 SERIES.



SEAL
No. 3868-000

SCALE -
FULL SIZE

GRAHAM-WHITE
the SALEM Line
1209 COLORADO STREET
SALEM, VIRGINIA 24153-1099

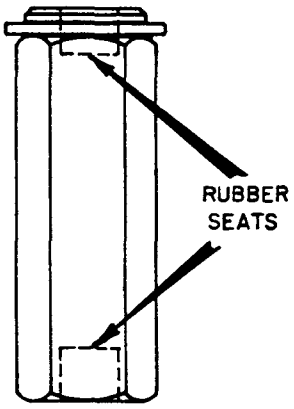
REPAIR KIT

FOR No. 5662-002 SOLENOID ASBY.

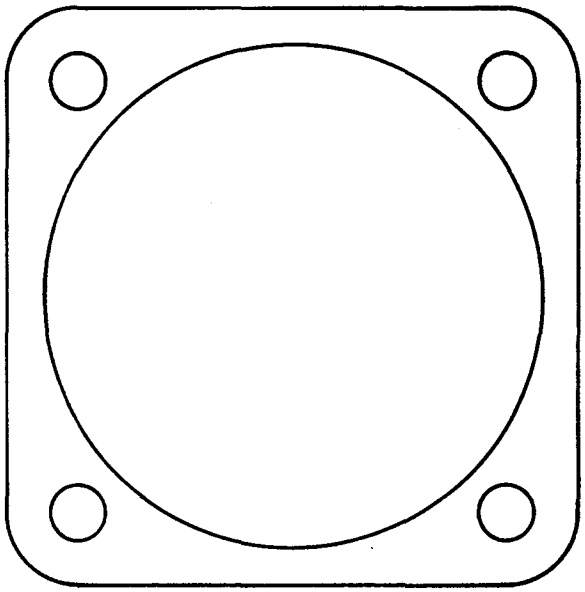
USED ON No. 975 SERIES

KIT 75-016

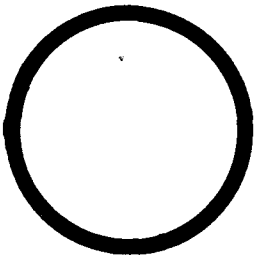
MAY 5, 1983



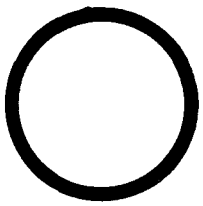
PLUNGER ASSEMBLY
No. 5662-009



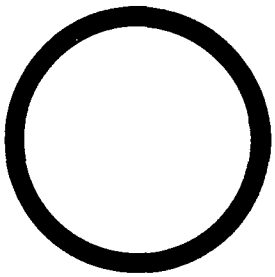
GASKET
No. 5662-030



SEAL
No. 5662-028



2 SEALS
No. 1951-000



SEAL
No. 5662-029

SCALE-
ACTUAL SIZE

NOTE-
FOR MAINTENANCE PROCEDURE REFER TO PRINT R & M 975-065 OR R & M 975-265 (BACK SIDE).

GRAHAM-WHITE SALES CORP.
1209 COLORADO STREET
SALEM, VIRGINIA 24153-1099

KIT 75-040

OVERHAUL KIT
FOR
975-100 SERIES TWIN TOWER AIR FILTER DRYER SYSTEM
2 to 3 Year Service

the SALEM Line

November 9, 1988

SYM	DATE	REVISION
A	2-22-90	Item 11 Qty was 2

ITEM	PART NO.	DESCRIPTION	QTY.
1	Kit 75-010	Seats and Seals for 975-055 Purge Valve (Single Seat)	2
2	Kit 75-011	Seals for 5661-020 Regenerating Orifice Assembly	1
3	Kit 75-012	Refill Kit for 5675-000 Desiccant Canister	2
4	Kit 75-013	Seals and Ball Seats for 5675-010 Compactor Assembly	2
5	Kit 75-014	Seats and Seals for 975-160 Inlet Check Valve	2
6	Kit 75-015	Seat and Seal for 975-265 Outlet Check Valve	2
7	Kit 75-016	Gasket, Seals and Plunger Assembly for 5662-002 Solenoid Assembly	2
8	Kit 75-018	Gasket and Element for 975-160 Precoalescer	1
9	Kit 75-050	Rebuild Parts for 5633-143 Humidity Indicator	2
10	Kit 75-210	Cup Washer, Seals and Seats for 975-253/-254 Double Seated Drain Valve	1
11	5660-110	Gasket for 975-160 Filter Body	1
12	5661-023	Gasket for 975-050 Dryer Body	2
13	5663-010	Gasket for 975-055/-253 Drain and Purge Valves	3
14	5660-024	Flange Gasket	6
15	5675-025	Seal for Outlet Manifold	2
16	5662-041	Gasket for Electrical Makeup Box	1

GRAHAM-WHITE
SALES DIV.

the SALEM Line

1209 COLORADO STREET
SALEM, VIRGINIA 24153-1099

the SALEM Line

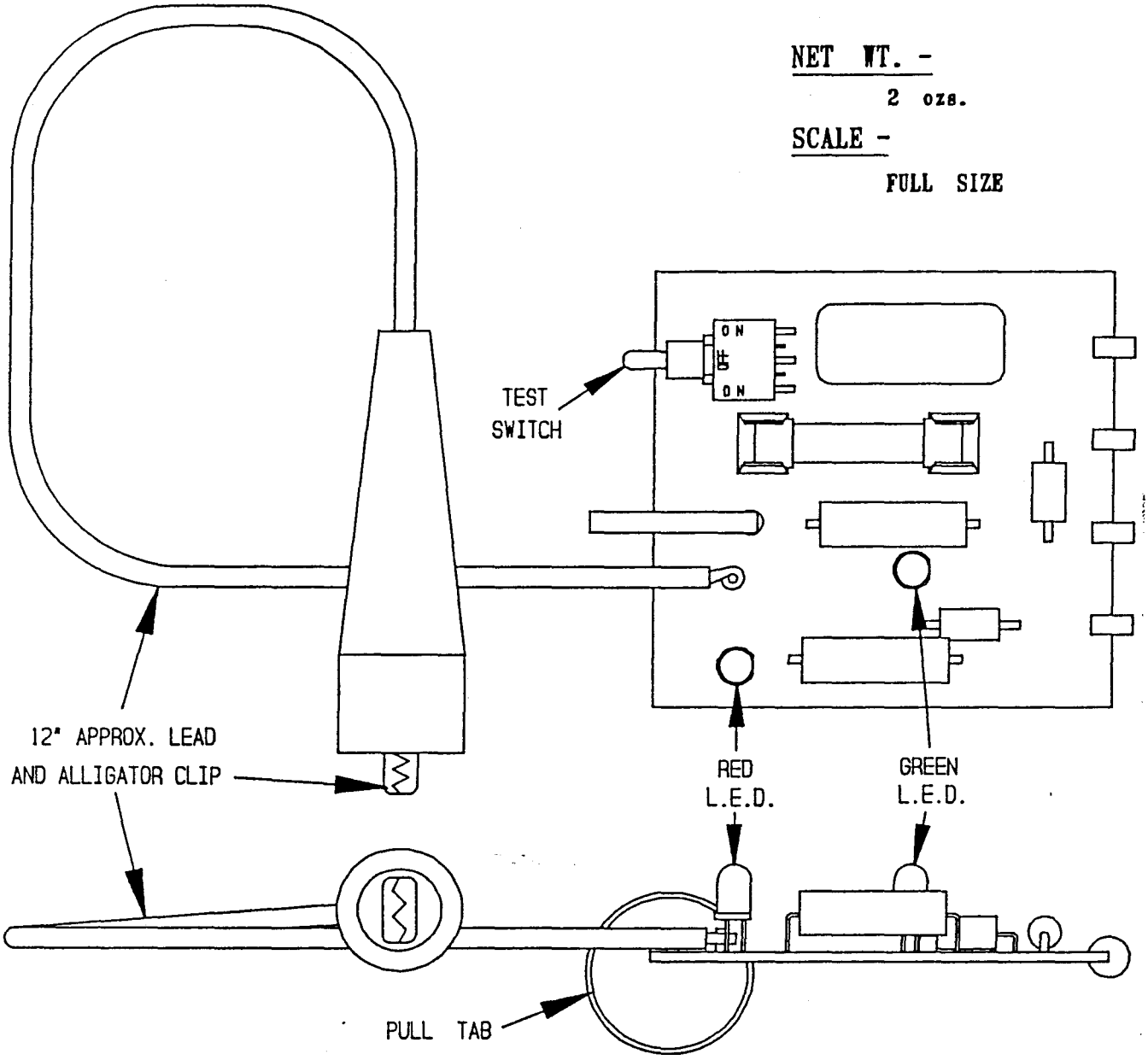
DRYER ANALYZER BOARD
(FOR No. 975-100 SERIES)

No. 5666-149

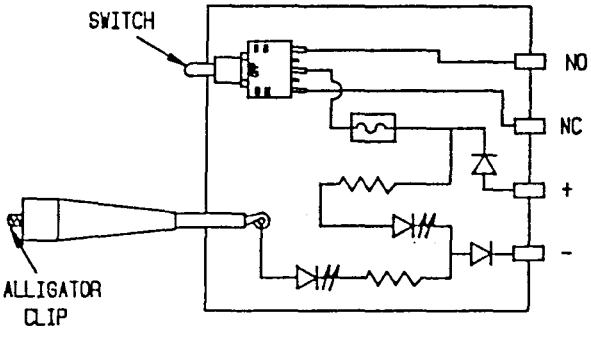
AUGUST 28 , 1989

NET WT. -
2 ozs.

SCALE -
FULL SIZE



ANALYZER BOARD SCHEMATIC



SEE BACK FOR
DRYER ANALYZER INSTALLATION
AND OPERATION PROCEDURE

GRAHAM—WHITE
SALES DIV.
the SALEM Line
1242 COLORADO STREET
SALEM , VIRGINIA 24153-1099

BRAKE REPAIR

It is not necessary to completely remove or disassemble the hoist brake unless a complete overhaul of the brake is required. The following service procedures are based on the brake being removed from the motor.

PISTON O-RING REPLACEMENT

To replace the O-Rings, refer to the assembly on page 6.1.4 and proceed as follows:

DANGER: DISCONNECT AND PLUG THE AIR LINE TO THE BRAKE BEFORE PROCEEDING WITH THE O-RING REPLACEMENT. Failure to remove air pressure could result in personal injury.

1. Remove the cover plate and capscrews from the piston.

2. Remove the twelve socket head screws which fasten the piston to the pressure plate.

CAUTION: Do not remove the stud nuts from the brake assembly while the piston socket head screws are out. This will release the brake spring pressure and make reassembly of the hoist brake more difficult.

3. Pull the brake piston from the brake assembly.

NOTE: Two tapped holes are provided in the face of the piston to aid in the removal and installation of the piston.

4. Remove the O-Rings from the piston.

5. Inspect and replace parts as necessary. Use new O-Rings.

6. Lubricate with Parker "O" lube or Magnalube "G" and install the O-Rings in the grooves on piston.

NOTE: The O-Rings must be clean, except for a light coat of lubricant, and must lay naturally in the O-Ring grooves. DO NOT TWIST THE O-RINGS.

7. Install the piston assembly into the bore of the cylinder. Prevent O-Ring damage during piston insertion by rotating the piston slightly as the O-Rings go over the edge of the cylinder bore.

8. Align the screw bores in the pressure plate and piston. Install socket head screws in steps alternating back and forth. Install the first two screws 180° apart, the next two 90° from the first, until all screws have their threads started.

9. Tighten the socket head screws in equal steps to 200 Ft.Lbs.

1. Operate the brake control solenoid valve if the system air pressure is available, or use a suitable air source and pressurize the brake cylinder to a minimum of 80 PSI.

CAUTION: Excessive air pressure may cause damage to the brake assembly. DO NOT EXCEED 125 PSI.

2. Measure the brake assembly for the full "release" dimensions.

DIMENSION NOTES:

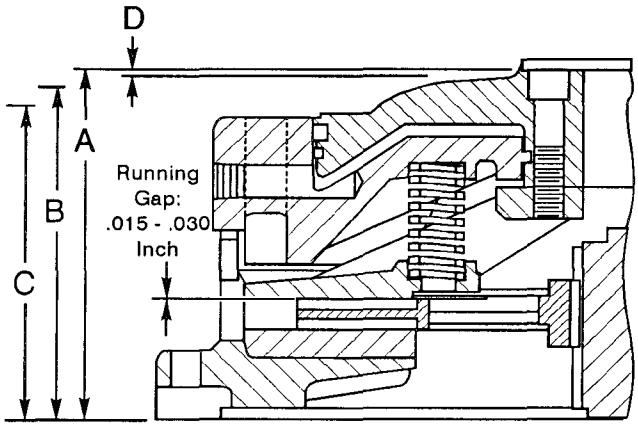
A. The height of a fully released brake is 9.10 inches.

B. The brake height when set, with new brake linings is 9.00 inches.

C. The brake height when set, with worn linings is 8.90 inches.

D. The maximum piston travel is .20 inch.

bkicaux6.wpg



CAUTION: Replace the disc when the piston travel reaches .20 inch. Additional travel will result in diminished breaking capacity, which would cause equipment damage and/or personal injury.

3. Set the brake by venting it and then measure the "set" dimensions.

4. When the dimension between full "set" and "release" (total stroke) reaches 0.125 inch, check the friction pad thickness on each side of the disc in several locations. If any of the pads are worn to 0.125 inch, replace the disc.

5. Replace the friction disc if it is contaminated with oil and/or grease.

BRAKE REPAIR

Repair of the propel brake assembly is limited to the replacement of excessively worn or damaged parts. Replace the friction disc if the linings are contaminated with oil and grease, or are worn to the limits for lining wear.

CAUTION: To ensure that safety precautions are observed during brake service, be familiar with all Removal/ Disassembly procedures.

BRAKE REPAIR

Repair of the propel brake assembly is limited to the replacement of excessively worn or damaged parts. Replace the friction disc if the linings are contaminated with oil and grease, or are worn to the limits for lining wear.

CAUTION: To ensure that safety precautions are observed during brake service, be familiar with all Removal/ Disassembly procedures.

PISTON O-RING REPLACEMENT

WARNING: SET THE BRAKE AND REMOVE OR BLOCK THE AIR LINE TO THE CYLINDER. AIR PRESSURE IN THE BRAKE COULD CAUSE DAMAGE TO PARTS OR CAUSE PERSONAL INJURY.

1. Remove the cover plate.
2. Remove the twelve socket-head capscrews which secure the piston to the pressure plate.

CAUTION: Do not remove the drive stud nuts from the brake assembly while the piston socket-head capscrews are out. This will release the brake spring pressure and make reassembly of the brake difficult.

3. Pull the piston from the brake assembly.

NOTE: Two tapped holes are in the face of the piston to aid in the removal and installation of the piston.

4. Remove the O-Rings from piston.
5. Inspect and replace parts as necessary.

PISTON REASSEMBLY

To assemble and install the brake piston:

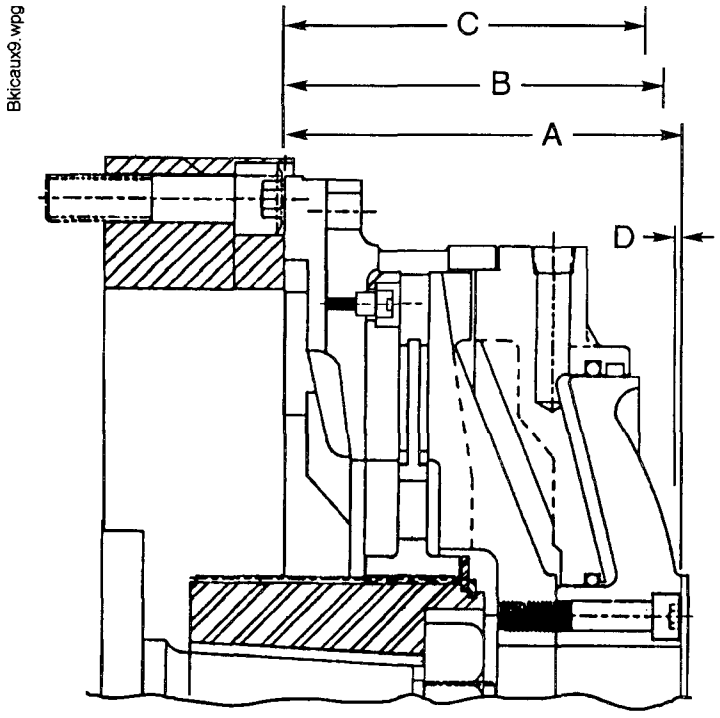
1. Lubricate and install O-Rings into the grooves on the piston. Use PARKER "O" Lube or Magnalube "G".

NOTE: The O-Rings must be clean, except for a light coat of lubricant, and must lay naturally in the O-Ring grooves. DO NOT TWIST THE O-RINGS.

1. Operate the brake control solenoid valve if the system air pressure is available, or use a suitable air source to pressurize the brake cylinder to a minimum of 85 PSI.

CAUTION: Excessive air pressure may cause damage to the brake assembly. DO NOT EXCEED 125 PSI.

2. Measure the brake assembly for the full "release" dimensions.



DIMENSION NOTES:

A. The height of a fully released brake is 8.61 inches.

B. The brake height when set, with new brake linings is 8.5 inches.

C. The brake height when set, with worn linings is 8.39 inches.

D. The maximum piston travel is .22 inch.

CAUTION: Replace the disc when the piston travel reaches .22 inch. Additional travel will result in diminished breaking capacity, which would cause equipment damage and/or personal injury.

3. When the dimensions between "full set" and "full release" (total stroke) reach 0.125 inch, remove the disc assembly and check for equal wear on each surface.

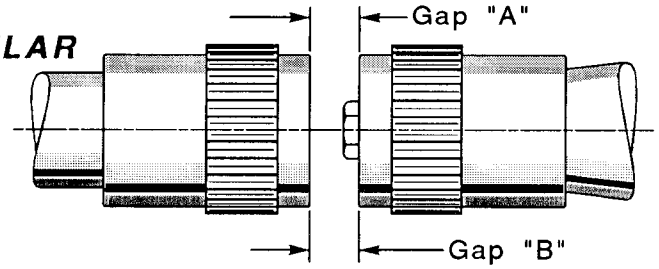
   a. If the disc surface wear is equal, reassemble the brake.

   b. If disc surface wear is unequal, reverse the position of the disc so that the inner side of the disc is toward the pressure plate, and the outboard side is toward the wear plate.

— Grid Coupling Data —

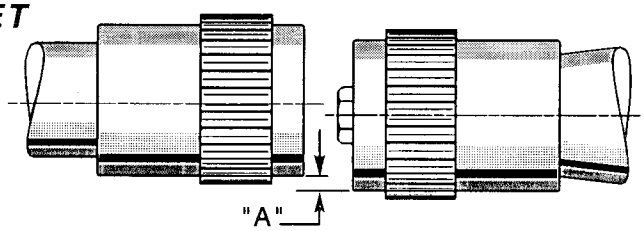
	CROWD	SWING	PROPEL
Motor Frame	812	816	814
Marion Part No.	601529-8	601250-7	601250-7
Vendor Part No.	112OT10	112OT10	112OT10
End Gap	.240	.250	.250
Alignment Limits			
Offset	.01	.012	.012
Angular	.01	.012	.012
Cover Bolt			
Torque~lb -in	650	650	650
No. of Bolts	4	4	4
Grease Wt.- Lbs.	1.60	1.60	1.60

ANGULAR



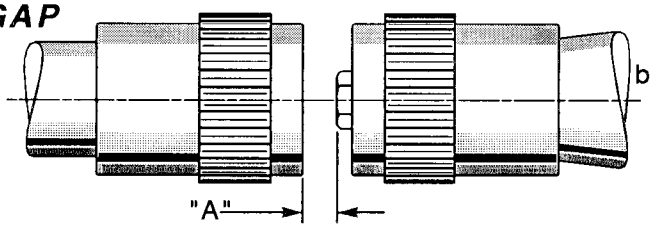
The ANGULAR alignment is the difference between Gap "A" and Gap "B".

OFFSET



The amount of offset between 2 shafts.

END GAP

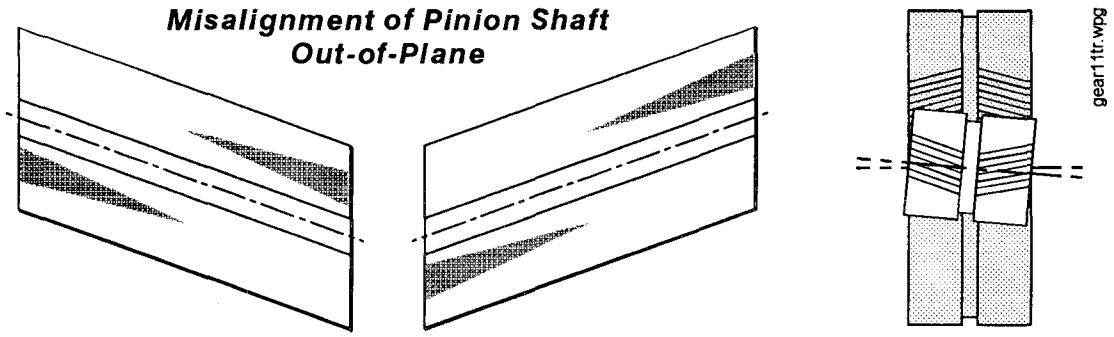


The minimum gap between the shaft ends. Push the motor shaft toward the pinion shaft to remove end-play.

couplings.wpg

RUNNING CLEARANCES for BRONZE BUSHINGS
Inches (Millimeters)

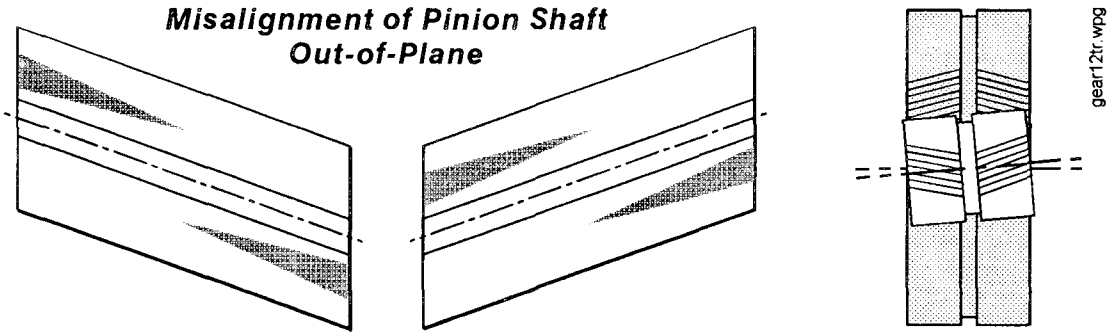
Shaft Nominal Diameter	Shaft Outside Diameter	Running Clearance	Shaft Nominal Diameter	Shaft Outside Diameter	Running Clearance
9.50 (241.3)	9.500-9.497 (241.300-241.224)	.016-.027 (.406-.686)	13.75 (349.25)	13.750-13.747 (349.250-349.174)	.021-.034 (.533-.864)
9.75 (247.65)	9.750-9.747 (247.650-247.574)	.016-.027 (.406-.686)	14.00 (355.6)	14.000-13.997 (355.600-355.524)	.022-.035 (.559-.889)
10.00 (254.0)	10.000-9.997 (254.000-253.924)	.016-.027 (.406-.686)	14.25 (361.95)	14.250-14.247 (361.950-361.874)	.022-.035 (.559-.889)
10.25 (260.35)	10.250-10.247 (260.350-260.274)	.016-.027 (.406-.686)	14.50 (368.3)	14.500-14.497 (368.300-368.224)	.022-.035 (.559-.889)
10.50 (266.7)	10.500-10.497 (266.700-266.624)	.016-.027 (.406-.686)	14.75 (374.65)	14.750-14.747 (374.650-374.574)	.023-.036 (.584-.914)
10.75 (273.05)	10.750-10.747 (273.050-272.974)	.016-.027 (.406-.686)	15.00 (381.0)	15.000-14.997 (381.000-380.924)	.024-.036 (.610-.914)
11.00 (279.4)	11.000-10.997 (279.400-279.324)	.017-.028 (.432-.711)	15.25 (387.35)	15.250-15.247 (387.350-387.274)	.024-.036 (.610-.914)
11.25 (285.75)	11.250-11.247 (285.750-285.674)	.017-.028 (.432-.711)	15.50 (393.7)	15.500-15.497 (393.700-393.624)	.024-.036 (.610-.914)
11.50 (292.1)	11.500-11.497 (292.100-292.024)	.017-.028 (.432-.711)	15.75 (400.05)	15.750-15.747 (400.050-399.974)	.024-.036 (.610-.914)
11.75 (298.45)	11.750-11.747 (298.450-298.374)	.017-.028 (.432-.711)	16.00 (406.4)	16.000-15.997 (406.400-406.324)	.026-.039 (.660-.991)
12.00 (304.8)	12.000-11.997 (304.800-304.724)	.017-.028 (.432-.711)	16.25 (412.75)	16.250-16.246 (412.750-412.648)	.026-.040 (.660-1.016)
12.25 (311.15)	12.250-12.247 (311.150-311.074)	.017-.028 (.432-.711)	16.50 (419.1)	16.500-16.496 (419.100-419.024)	.026-.040 (.660-1.016)
12.50 (317.5)	12.500-12.497 (317.500-317.424)	.017-.028 (.432-.711)	16.75 (425.45)	16.750-16.746 (425.450-425.348)	.026-.040 (.660-1.016)
12.75 (323.85)	12.750-12.747 (323.850-323.774)	.019-.030 (.483-.762)	17.00 (431.8)	17.000-16.996 (431.800-431.724)	.027-.041 (.685-1.041)
13.00 (330.2)	13.000-12.997 (330.200-330.124)	.020-.033 (.508-.838)	17.25 (438.15)	17.250-17.246 (438.150-438.024)	.027-.041 (.685-1.041)
13.25 (336.55)	13.250-13.247 (336.550-336.474)	.020-.033 (.508-.838)	17.50 (444.5)	17.500-17.496 (444.500-444.398)	.027-.041 (.685-1.041)
13.50 (342.9)	13.500-13.497 (342.900-342.824)	.020-.033 (.508-.838)	17.75 (450.85)	17.750-17.746 (450.850-450.748)	.027-.041 (.685-1.041)



Corrective Adjustment:

Move the left hand drum shaft bearing housing *forward* and remove shims to *lower*.

NOTE: For every .001 inch of adjustment required at the gear / pinion, move the left hand bearing housing approximately .0024 inch *forward* and .0065 inch *down*.



Corrective Adjustment:

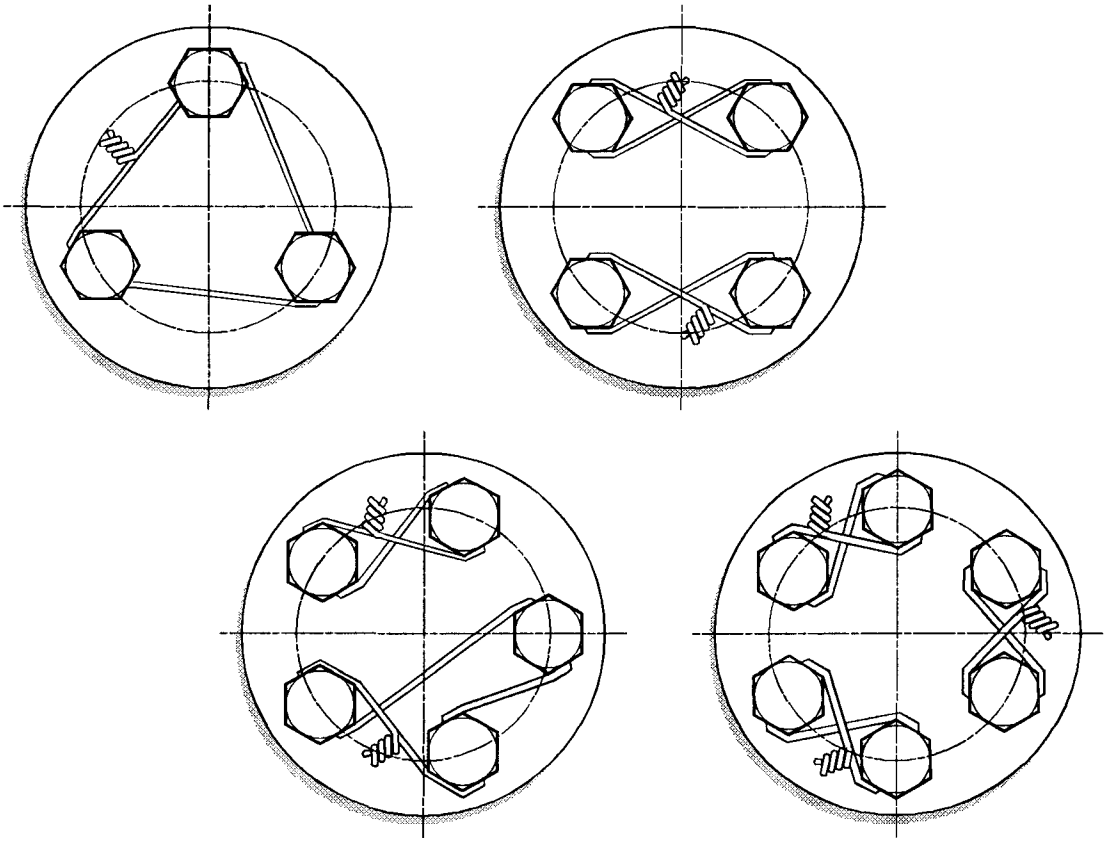
Move the left hand drum shaft bearing housing to the *rear* and add shims to *raise*.

NOTE: For every .001 inch of adjustment required at the gear / pinion, move the left hand bearing housing approximately .0024 inch to the *rear* and .0065 inch *up*.

WIRE LOCKING CAPSCREWS

Wire locking of capscrews is used when maximum lock assurance is required when periodic visual inspection is not possible.

The illustrations below show the recommended wire locking methods for various right hand thread capscrew patterns. For patterns not shown, wire lock the screws "in pairs". For odd numbered patterns, wire lock the screws in pairs except the remaining 3 capscrews wire lock together.



wirelock.wpg

PATTERNS for WIRELOCKING CAPSCREWS

Use 14 gauge soft annealed lockwire. Thread the wire through the capscrew head so that tightening stress on the wire will exert a tightening torque on the direction of capscrew thread. (The illustrations show lock wire threading for right hand threaded capscrews. Reverse the lock wire patterns shown for left hand capscrews.)

When repairing a part in the field or shop, all the convenient facilities are not available for preheating. Probably the most common preheating device is a heating torch which uses oxygen and some type of fuel or another preheating device such as resistant heaters. It is important when using a preheating torch to allow the heat to soak into the part gradually, a minimum of 3 inches (76 mm) beyond the repair area in all directions. The surrounding repair area should be covered with an insulating blanket to keep the heat from dissipating too fast. A temporary furnace can be made to preheat large parts. All repairs should be sheltered from cold drafts. This can be done by building a temporary shelter around the part if it can not be taken to a shop.

Do not short change the repair by skimping on the preheat. It is always better to preheat than to repair a job without preheat plus the chances of a successful repair are better. The only steel where preheating temperatures can be detrimental to the repair is austenite manganese steel. This type of steel may be used on bucket or dipper lips, track pads, drive tumblers and dipper racks. The preheat and interpass temperature should never go beyond 400°F(204°C). This steel can be quickly determined by the use of a magnet since it is a nonmagnetic material.

STEP 7 -- Welding Techniques.

The first and most important part of a repair procedure is to pick your best welder or welders who will follow explicit welding repair procedures. This type of welder is a person who enjoys such challenges even when he is in an uncomfortable position and the preheat is uncomfortable.

A technique highly recommended for a repair is to butter the groove with weld metal. What is buttering and what does buttering do for you? Buttering is the addition of one or more layers of weld metal to the face of the joint or surfaces to be welded. Every weld repair of a large structure can be considered a high restraint joint, therefore, buttering is highly recommended. If we examine the mechanical properties of parent material and weld metal, we find the weld metal will have the best ductility. We know when weld metal cools shrinkage stresses will be created, therefore, when the center joining passes are put in, the weld metal will be pulling on the butter passes instead of the parent material which has less ductility.

The buttering assures all finish weld beads will be made only into previously deposited weld metal resulting in maximum tempering of previously created fusion and heat affected zones in the base materials. Buttering can also be used to reduce the high preheat required for high alloy steels. Many times a repair does not require the hardenability or heat treatment of the parent material, therefore, high strength electrodes are used for the repair. The parent material can be buttered with two layers of weld metal at the recommended preheat for the parent material and then the preheat can be lowered to about 200°F (93°C) for the comfort of the welder. A good example would be the changing of racks on dipper handles. The racks are usually made of an alloy steel which requires a preheat of 450 - 500°F (232 - 260°C). The rack bevel could be preheated and buttered with a layer of the required weld metal. The racks would then be installed on the dipper handle and then preheated to about 200 - 250°F (93 - 121°C) and welded eliminating the high preheat required to weld the assembly.

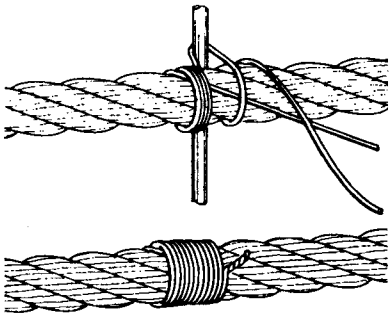
SEIZING WIRE ROPE

While there are numerous ways to cut wire rope, in every case, certain precautions must be observed. For one thing, proper seizings are always applied on both sides of the place where the cut is to be made. In a wire rope, carelessly or inadequately sized, ends may become distorted and flattened, and the strands may loosen. Subsequently, when the rope is put to work, there may be an uneven distribution of loads to the strands; a condition that will significantly shorten the life of the rope.

The two widely accepted methods of applying seizing are illustrated. The seizing itself should be soft, or annealed wire or strand. Seizing wire diameter and the length of the seize will depend on the diameter of the wire rope. But the length of the seizing should never be less than the diameter of the rope being seized. Normally, for preformed ropes, one seizing on each side of the cut is sufficient. But for ropes that are not preformed, a minimum of two seizings on each side is recommended; and these should be spaced six rope diameters apart.

Lay one end of the seizing wire in the groove between two strands; wrap the other end *tightly* in a close helix over a position of the groove using a seizing iron (a round bar 1/2" to 5/8" diam. x 18" long) as shown above. Both ends of the seizing wire should be twisted together tightly, and the finished appearance as shown below. Seizing widths should not be less than the rope diameter.

wrp_sz-a.wpg



Seizing METHOD A

3. *Reduction in rope diameter*:

Any marked reduction rope diameter indicates degradation. Such reduction may be attributed to:

- Excessive external abrasion.
- Internal or external corrosion.
- Loosening or tightening of rope lay.
- Inner wire breakage.
- Rope stretch.
- Ironing or milking of strands.

In the past, whether or not a rope was allowed to remain in service depended to a great extent on the rope's diameter at the time of inspection. Currently this practice has undergone significant modification.

Previously, a decrease in the rope's diameter was compared with published standards of minimum diameters. The amount of change in diameter is, of course, useful in assessing a rope's condition. But, comparing this figure with a fixed set of values can be misleading. These long-accepted minimums are not, in themselves, of any serious significance since they do not take into account such factors as:

1) Variations in compressibility between IWRC and Fiber Core.

2) Differences in the amount of reduction in diameter from abrasive wear, or from core compression, or a combination of both.

3) The actual original diameter of the rope rather than its nominal value.

As a matter of fact, all ropes will show a significant reduction in diameter when a load is applied. Therefore, a rope manufactured close to its nominal size may, when it is subjected to loading, be reduced to a smaller diameter that stipulated in the minimum diameter table. Yet, under these circumstances, the rope would be declared unsafe although it may, in actuality, be safe.

As an example of the possible error at the other extreme, we can take the case of a rope manufactured near the upper limits of allowable size. If the diameter has reached a reduction to nominal or slightly below that, the tables would show this rope to be safe. But it should, perhaps, be removed.

Today, evaluations of the rope diameter are first predicated on a comparison of the original diameter—when new and subjected to a known load—with the current reading under like circumstances. Periodically, throughout the life of the rope, the actual diameter should be recorded when the rope is under equivalent loading and in the same operation section. This procedure, if followed carefully, reveals a common rope characteristic: after an initial reduction, the diameter soon stabilizes. Later, there will be a continuous, albeit small, decrease in diameter throughout its life.

Section 8

Preventive Maintenance

8.1 DESCRIPTION

Preventive Maintenance Programs may be defined as a systematic series of operations performed periodically on equipment to prevent breakdowns.

Any breakdown *WILL* reduce productivity and increase overhead expense. Machinery is only new at one point in time. From that moment, the machinery begins to deteriorate through use and aging. A well organized maintenance program will avoid unexpected high-cost breakdowns and will increase component life.

A systematic approach to the program should be followed, and detailed records of all findings kept, to detect potential problem areas. Valuable time and effort can be saved if defects are corrected before they lead to a major breakdown. The records should be reviewed often and kept on file for future reference.

Personnel involved in the program should go through an established training program, to know *WHAT* to check and *HOW* to rectify any potential problem area. When personnel are able to do routine maintenance and normal repairs efficiently, downtime is reduced and machine productivity increased. Also, to keep the machine in good running condition, the necessary parts, tools and current information should be kept on hand.

Equipment maintenance is a science and its practice an art. This art can be divided into 6 types of operations - they are:

Inspection is probably the most important operation. Careful observation is required of all parts of the equipment. Slight abnormalities may not interfere with the equipment performance BUT those that are a deviation from the normal should be discovered early. When inspecting, notice placement, state of cleanliness, color, etc. of part(s). Example: discoloration indicates overheating; all guards, bolts in place and good housekeeping.

Cleaning, and keeping clean, is essential for good operation. Periodic cleaning should be more frequent on exposed parts than those which are contained within cabinets. Parts, connections and joints should be free of dust, corrosion and other foreign matter.

A *Feeling* operation is used more often to check guarded rotating machinery for vibration due to worn parts, lack of lubrication, overheating, etc. Feeling operation on electrical items should be performed as soon as possible *AFTER* power has been removed and the circuit grounded. Feeling of excessive heat may indicate an overloaded condition and should be corrected.

SHOVEL NO.: DATE:

INSPECTION SCHEDULE	SERVICE HOURS 250	500	1000	REMARKS
3. SWING MACHINERY:				
a) Swing Gearcases - check oil level, clean breather, check for loose bolts and leaks. Take oil sample.	X			
b) Swing Motors - check hold down bolts and ensure no loose covers.	X			
c) Swing Brakes - remove guards and measure linings. Replace and adjust as required.	X			
4. GANTRY ASSEMBLY:				
a) A-Frame Compression Member Structure - check for cracks. Indicate location of cracks in comments section of service sheet.		X		
b) A-Frame Tension Member Structure - check for cracks. Indicate location of cracks in comments section of service sheet.		X		
c) check all pins and retainers; check lube to all pins; check walkway; check for pendant rope damage		X		
5. AIR SYSTEM:	X			
a) Auxiliary Air - check the following: - check compressors for correct operation (including safety valves). Cut-in 125 PSI (870 kPa) and Cut-out 150 PSI (1050 kPa) - check belts and guards - check air receiver, drain water, remove inspection cover and check for rust - check air lines, lubricators (refill) and water traps (drain) - check correct operation of pressure switches - check operation of air receiver auto water dump valve				

• ROTATING FRAME •

1. Structural damage:
   a. Paint cracks or ripples?
   b. Plate distortion?

2. Cracked welds?

3. Main rotating shaft housings:
   a. Lubrication?
   b. Bearing temperature?
   c. Seals?

4. Inspect center journal:
   a. Is there evidence of overheating?
   b. Is lubrication adequate?
   c. Clearance under nut?
   d. Side movement?

5. Inspect lubrication lines:
   a. Evidence of damaged lines?
   b. Leakage evident?
   c. Loose clamps?

6. Inspect air piping lines:
   a. Damaged lines?
   b. Leaks?
   c. Loose clamps?

7. Boom foot lugs:
   a. Cracks or damage?

8. Inspect gantry:
   a. cracks or damage?
   b. Pin wear and retainers?

• SWING MACHINERY •

1. Swing gearcase:
   a. Gearcase bolts?
   b. Motor mounting bolts?
   c. Guards?
   d. Noise?
   e. Oil level?
   f. Leaks?
   g. Brake operation?
   h. Brake linings?

[Chart #5]

351M MINING SHOVEL
PROJECTED MAINTENANCE SCHEDULE

DESCRIPTION	QTY/ MACH.	OPERATING HOURS X 1000																				
		10		20		30		40		50		60		70		80		90		100		
Handle Assembly																						
Bushing (Dipper)	12		R		R		R		R		R		R		R		R		R		R	
Sheave (Equalizer)	2				R				R				R				R					R
Bushing (Equalizer)	2		R		R		R		R		R		R		R		R		R		R	
Pin (Equalizer)	2		R		R		R		R		R		R		R		R		R		R	
Bumper (Rubber)	2				R				R				R				R					R
Handle Structure	1				R				X				X				X					X
Rack Weldment	1				R				R				R				R					R
Wear Plate (Top)	3				R				R				R				R					R
Dipper Assembly																						
Latch Bar	1	Replace and Exchange for Rebuild every 100 Hours																				
Lever	1	Replace and Exchange for Rebuild every 1000 Hours																				
Insert (Latch)	2	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
Bush (Hinge)	2		R		R		R		R		R		R		R		R		R		R	
Door Structure	1		R		X		X		X		X		X		X		X		X		X	
Door Snubber																						
Pad (Friction)	12	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
Plate (Snubber)	6	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
Plate (Snubber)	6	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
Dipper & Handle Assembly																						
Dipper Front (Struct)	1		R		X		X		X		X		X		X		X		X			X
Bushing (Structure)	4		R		R		R		R		R		R		R		R		R			R
Pin (Dipper)	3		R		X		X		X		X		X		X		X		X			X
Pin (Dipper)	1		R		X		X		X		X		X		X		X		X			X
Pin (Door)	2		R		X		X		X		X		X		X		X		X			X
Lever (Latch)	1	R	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

X = Exchange for Rebuild R = Replace W = Weld Repair

About once a year, or after 7500 operating hours, purge the bearings by pumping enough lube through the bearing while running so that new grease appears at the shaft or bottom plug hole. *IMPORTANT!* — As lube seeps out along the shaft, wipe it away. Finally, after 15 or 20 minutes of operation, thoroughly clean off the shaft. New grease usually appears first at the bottom hole, but it may be seen first at the shaft. *DO NOT FORGET THE DRAIN PLUG.*

Whenever possible, about once every 2 years, disassemble the bearings and remove ALL the old lube by thoroughly cleaning with light oil or petroleum solvent. Each time the bottom plug is removed, push a clean wire into the hole to insure that the lube is not hard and plugging the hole.

When repacking bearings with fresh grease, the housings or grease reservoirs should be filled from ½ to 2/3 full. An excessive amount of grease in the bearing will cause excessive bearing temperatures. See table 2 below.

Bearing Lubrication Data - *Table 2*

Minimum amount of grease (reservoir ½ full) and maximum amount of grease (reservoir 2/3 full) at each bearing.

Frame Size	Grease			
	(inches^3)	(centimeters^3)	(ounces)	(grams)
802	3.5-4.5	57-74	1.75-2.25	50-64
803	4-5.5	66-90	2-2.75	50-78
804	5-7	82-115	2.5-3.5	71-99
806	6.5-9	107-147	3.25-4.5	92-128
808	8.5-11.5	139-188	4.25-5.75	120-163
810	13-17.5	213-287	6.5-8.75	184-248
812	17-23	279-377	8.5-11.5	241-326
814	20-27	328-442	10-13.5	284-383
816	24-32	393-524	12-16	340-454
818	24-33	393-541	12-16.5	340-468
820	29-38	475-623	14.5-19	411-539
822	34-45	557-737	17-22.5	482-638
824	42-51	688-836	21-25.5	595-723
828	67-78	1098-1278	33.5-39	950-1106

9.3 REFERENCE PUBLICATIONS

For Detailed Electrical Information,
Refer to the
ELECTRICAL INSTRUCTION MANUAL

For Information on the
MAIN COLLECTOR RINGS and the
AUXILIARY COLLECTOR RINGS,
Refer to Section 4 of this manual.

Marion provides (under separate cover) a PARTS BOOK from the electrical manufacturers in addition to the information supplied in this section and the above sources.

1.0.0 DESCRIPTION of UNIT

The MPV8 is a heavy duty system suitable for rooftop mounting on the cabs and electrical enclosures of large pieces of mining and industrial equipment. This includes shovels, draglines, drills, ship loaders, and track maintenance equipment. Case is stainless steel.

Evaporator:

Air is drawn from under the unit, passes over the heat exchange coil (and heating elements when fitted) into the double wheel fan deck and is discharged through the base into the conditioned space.

Refrigerant flow is metered by an externally equalized TX valve, and is cut off by a liquid line solenoid valve.

Heat exchange coil is large, with heavy gauge tubing and coarse fin pitch to reduce clogging.

Fan motor is single shaft and of totally enclosed, fan cooled motor construction.

Drain pan is large and of "V" design for ease of cleaning and to facilitate draining.

All pressure controls are in the evaporator section.

Condenser:

The compressor is a heavy duty, 2 cylinder, suction, gas cooled, semi-hermetic unit. The assembly is mounted to heavy flexible mounts to reduce noise transmission to the structure.

All connections are stainless and most joints are soldered.

A large filter drier is mounted in the liquid line to filter and remove moisture from the refrigerant. Isolation valves are installed on either side to enable refrigerant to be "pumped down" and thus enabling core to be replaced without total loss of refrigerant.
Condenser fan is single speed.

CHAPTER 3

SERVICING

5.0.0 DRAWINGS

T9006001	Parameter
P9006005	General Assy. Dwg. With Balloons
AE9006004	Electrical Schematic

PHYSICAL DATA

Boiling Point	-26.2°C (-15.2°F) at 736 mm Hg.
Vapor Pressure	96 psia at 25 deg C (77 deg F)
Vapor Density	3.60 (Air = 1.0) at 25 deg C (77 deg F)
% Volatiles	100 WT %
Water Solubility	0.15 WT % at 25°C (77°F) and 14.7 psia
Odor	Slight ethereal
Form	Liquefied gas
Color	Clear, colorless
Density	1.21 g/cc at 25 deg C (77 deg F) - Liquid

HAZARDOUS REACTIVITY

Instability	Material is stable. However, avoid open flames and high temperatures.
Incompatibility	Incompatible with alkali or alkaline earth metals- powdered Al, Zn, Be, etc.
Polymerization	Polymerization will not occur.

Decomposition : Decomposition products are hazardous. "SUVA" Cold-MP can be decomposed by high temperatures (open flames, glowing metal surfaces, etc.) forming hydrofluoric acid and possibly carbonyl fluoride.

FIRE AND EXPLOSION DATA

Flash Point	Will not burn
Method	TOC
Flammable Limits in Air, % by Volume	LEL Not applicable UEL Not applicable
Autoignition	>750°C (>1,382°F)

"SUVA" Cold-MP is not flammable at ambient temperatures and atmospheric pressure. However, "SUVA" Cold-MP has been shown in tests to be combustible at pressures as low as 5.5 psig at 177 deg C (351 deg F) when mixed with air at concentrations of generally more than 60 volume % air. At lower temperatures, higher pressures are required for combustibility. Experimental data have also been reported which indicate combustibility of HFC-134a in the presence of certain concentrations of chlorine.

Fire and Explosion Hazards	Cylinders may rupture under fire conditions. Decomposition may occur.
Extinguishing Media	As appropriate for combustibles in area.
Special Fire Fighting Instructions	Cool cylinders with water spray. Self-contained breathing apparatus (SCBA) may be required if cylinders rupture or release under fire conditions.

(continued)

2.2.0 Commissioning (cont')

Rotate the knob of the thermostat to maximum, and observe that the condenser fan will stop, but the compressor will continue running through an unloaded cycle until the pressure falls below 18 psi and it will stop. This is the pumpdown facility.

NOTE : The liquid/moisture indicator is inoperable on this system (and all 134a systems) as the lubricant and refrigerant discolor the die. This is normal, and there is nothing that is currently available to overcome this problem.

7.0.0 134a SPECIFIC TOOLS

665-C027 UV Lamp

532-C005 Manifold Gauge Set with Isolation Valves at Hose Ends.

DU PONT

Du Pont Chemicals

MSDS MATERIAL SAFETY DATA SHEET

2187FR | Revised 22-Jan-93 | Printed 31-Mar-93

"SUVA" COLD-MP

MATERIAL IDENTIFICATION

Corporate Number	DU002794

"SUVA" is a registered trademark of Du Pont.

Manufacturer/Distributor	DuPont 1007 Market Street Wilmington, DE 19898	
Phone Numbers	Product Information Transport Emergency Medical Emergency	1-800-441-9442 CHEMTREC: 1-800-424-9300 1-800-441-3637
Chemical Family	HALOGENATED HYDROCARBON	
Trade Names and Synonyms	"SUVA" 134a HFC 134a	
Du Pont Registry Number	DP133-61-3	
Formula	CH2FCF3	
TSCA Inventory Status	Reported/Included	
NPCA-HMIS Ratings	Health: 1 Flammability: 0 Reactivity: 1 Personal Protection rating to be supplied by user depending on use conditions.	

COMPONENTS

Material	CAS Number	Percent
ETHANE, 1,1,1,2-TETRAFLUORO- (HFC-134a)	811-97-2	100

(continued)

Operator's Manual

1 GENERAL INFORMATION

This manual is designed to assist the owner in the operation and preventive maintenance of this machine. Following easy to understand step-by-step procedures, maintenance personnel can perform these tasks in a safe manner. When a systematic and thorough maintenance/service procedure (a responsibility of the maintenance superintendent) is used for this machine, minimum unplanned downtime and reliable operation will result.

THIS MANUAL IS NOT THE PARTS BOOK, and cannot be used to order parts. A separate, detailed parts book has been supplied. Please carefully read the instructions in it. All parts are listed by group and/or product code numbers with item/part numbers for **THIS SPECIFIC MACHINE.** Order parts in exact quantity. Parts ordered by mistake and returned, are subject to a rehandling charge. *RIGHT HAND* and *LEFT HAND* parts on the upper frame correspond to the operator's hands at the controls; as seated when operating the machine. Please state the correct machine *SERIAL NUMBER* (located on a plate in the operator's cab) when corresponding or contacting factory service or parts departments. Records on each machine are filed by serial number and when given this number, your machine's specific design and original equipment is accessed quickly by the Marion parts representative.

Periodic additions or revisions may be made to this manual. These will be mailed direct to you from the factory. Should you require additional information or factory service assistance contact your regional service representative or

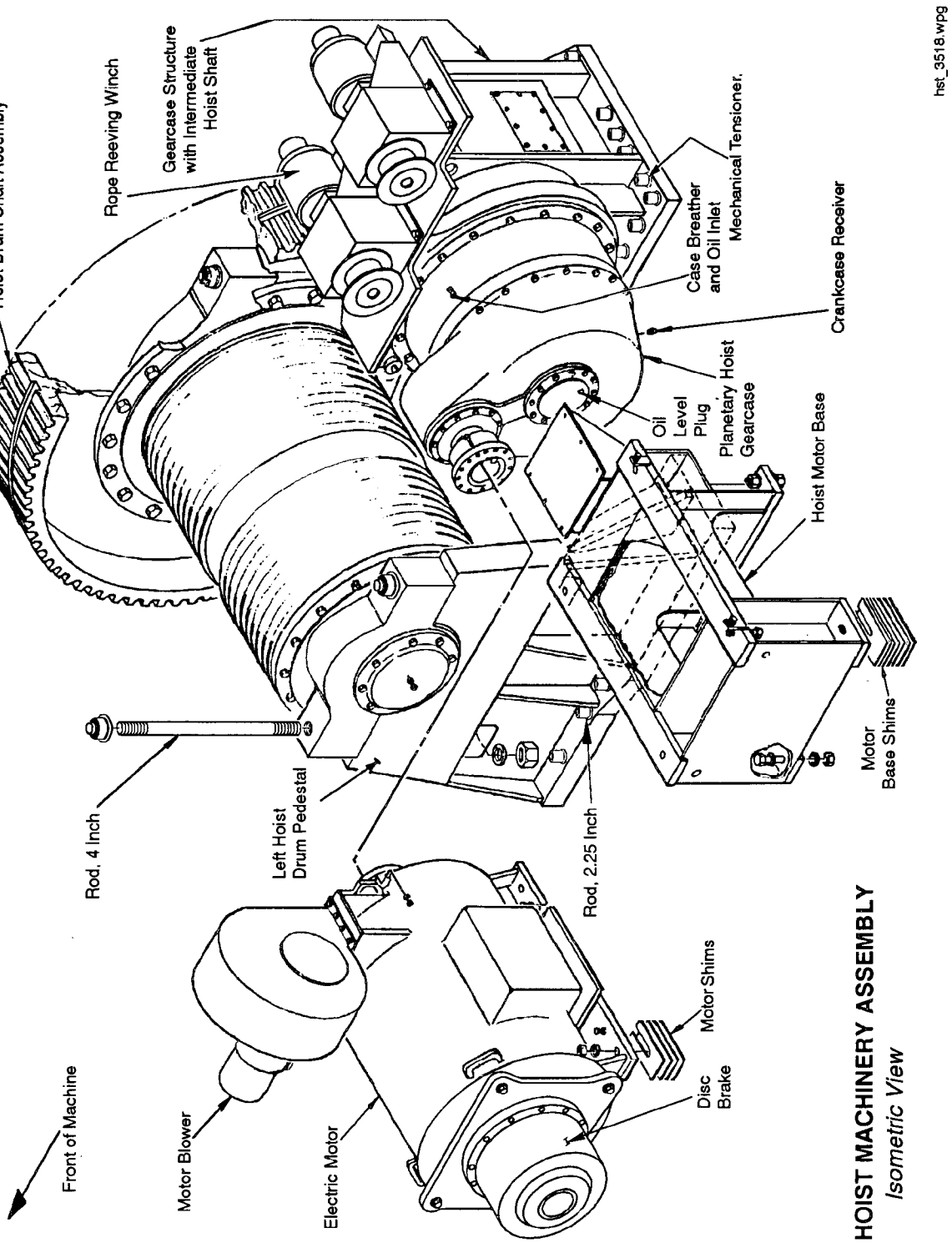
Service Department
The Marion Power Shovel Company
617 West Center Street
P.O.Box 505
Marion, OH 43301-0505

- or -

Telephone 614/383-5211
Telex 24-5307
Telecopier 614/383-5211

It is Marion's policy to improve its products whenever possible and practical to do so. The company reserves the right to make changes or add improvements at any time without incurring any obligation to install such changes on machines sold previously.

Due to this continuous program of product research and development some procedures, specifications and parts may be altered in a constant effort to improve machines.



351M HOIST MACHINERY

STAIRWAY CONTROL STATION: Press the pushbutton to raise the stairway. A green light indicates the stairway is down.

DANGER: **NEVER BOARD THE STAIRWAY UNTIL IT IS COMPLETELY LOWERED. Boarding the stairway while it is in motion can cause personal injury.**

LOWER LIMIT: Prevents L.E. activation and lights the red ladder down indicator on the cab annunciator panel.

UPPER LIMIT: Allows machine operation. Activates the green indicator on the control station when the ladder is down.

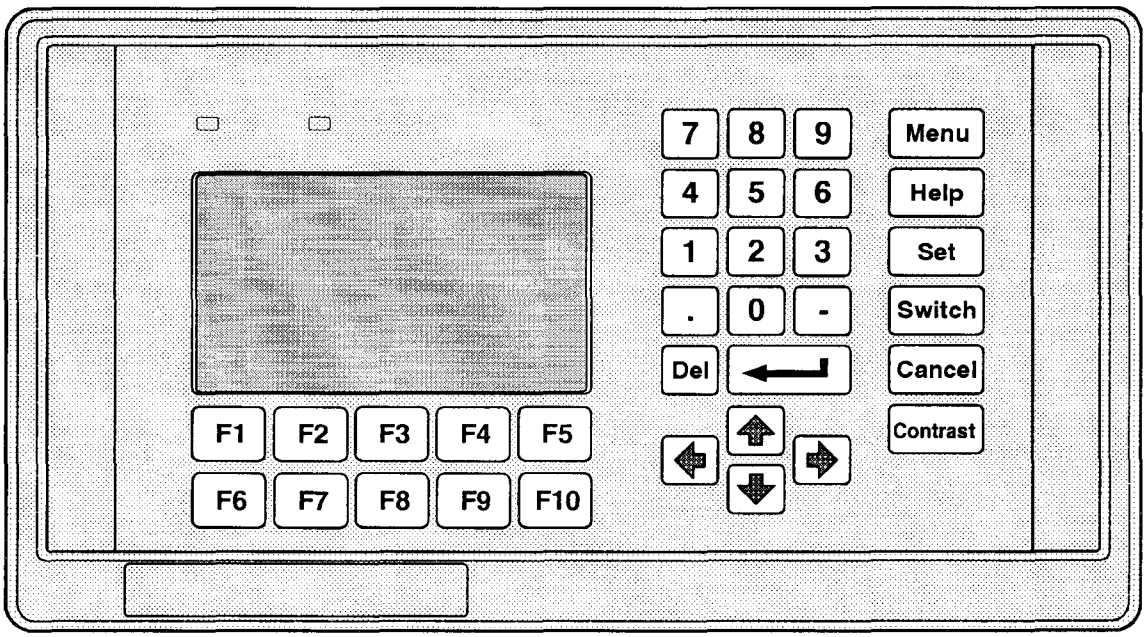
NOTE: When the ladder is in the *UP* position, the control valve is energized 42 seconds after L.E. is activated, to prevent inadvertent lowering of the ladder while the machine is in operation.

The components on the O.I.U. are:

DISPLAY SCREEN - The particular computer program that is currently accessed should be visible on the display screen. Each display on the O.I.U. has unique indicators shown vertically beside function keys F1 through F10 that clearly label each key's function in that particular program.

FUNCTION KEYS - These are used by the operator to send instructions to the computer. Keys F1 through F10 are clearly labeled on the screen beside them as to their function in each program.

Function Key F10 and MENU are used in all programs to select the main screen.



oiud3114.wpg

OPERATOR INTERFACE UNIT DISPLAY PANEL

KEY PAD - The keys on the right next to the display screen are used to enter codes or alter program parameters if permitted.

The 10 number keys and the *ENTER* key are used to enter data into selected programs as directed and if permitted. Refer to the MARION PROGRAMMABLE SYSTEM manual for this machine for more information on this function.

IMPORTANT NOTE: When using the *NEXT SCREEN* or *PREVIOUS SCREEN* keys in the various *O.I.U.* displays, *PREVIOUS SCREEN* selects the last page in the program if the operator is currently on its first page and *NEXT SCREEN* selects the first page in the program if currently on its last page.

4 OPERATOR CONTROLS in the MACHINERY HOUSE

The controls used for start-up and/or shutdown of the machine are located on the Starting Panel in the machinery house at the rear of the right wing. Refer to the figure below. The Staring Panel contains the following components:

PHASE SEQUENCE - a red indicating light which, if illuminated, indicates a phase sequence error in the power supply. Electrical interlocks will prevent machine start-up if phase reversal exists. This has a "push to test" feature for checking the light.

PLC OK - A green indicating light used to display the status of the PLC / Failsafe Relay.

VOLTAGE INSIDE TOLERANCE - A green indicating light used to display the status of the incoming voltage between tolerance.

EMS RELAY - (Push to Reset) A green indicating light used to display the status of the Emergency Stop Relay (EMS).

ANTI-CONDENSATION HEATER - a 2-position selector switch: *AUTO* automatically energizes the heaters when the machine is shut down; *OFF* turns them off. These heaters should be used during periods of high humidity or low temperatures.

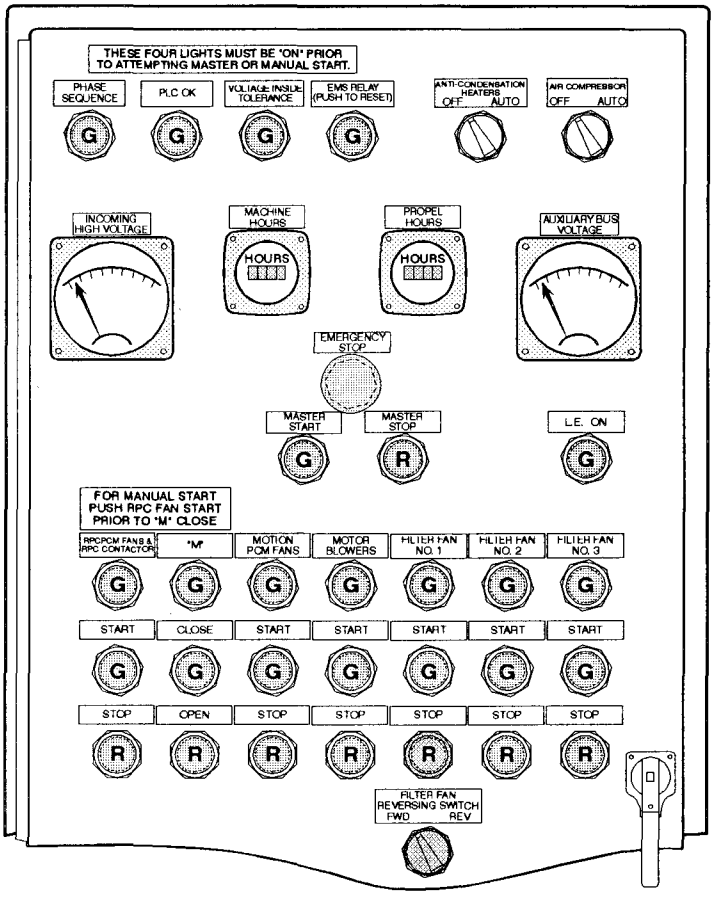
AIR COMPRESSOR - a 2-position selector switch. This must be set to AUTO for machine operation so the air compressor will function to supply air automatically. *OFF* position turns it off.

INCOMING HIGH VOLTAGE - an A.C. voltmeter that indicates the incoming voltage.

MACHINE ETM - an elapsed time meter that shows total machine operating hours with excitation (L.E.) on.

PROPEL ETM - A meter which shows the machine time in PROPEL mode.

AUXILIARY BUS VOLTAGE - an A.C. voltmeter that indicates the voltage on the secondary side of the auxiliary transformer.



STARTING PANEL

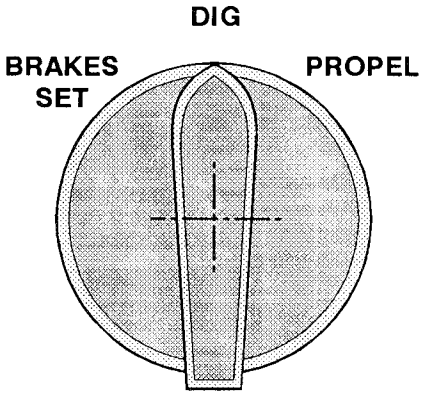
Because the swing motion is torque controlled, the machine will coast when the controller is returned to neutral. The swing motion is slowed or stopped by "*plugging*" the swing motions. This is accomplished by the operator moving the joystick lever in the opposite direction to that the drive is going, thus instructing the motor(s) to rotate in the reverse direction. In this way, the motor(s) dynamically brake the Swing. The Hoist, Crowd and Propel motions are speed controlled which means the controller position is directly related to motor speed. Therefore, when the controller is returned to the neutral position the motor will automatically plug to a stop. Stopping time can be increased only slightly by moving the controller in the opposite direction.

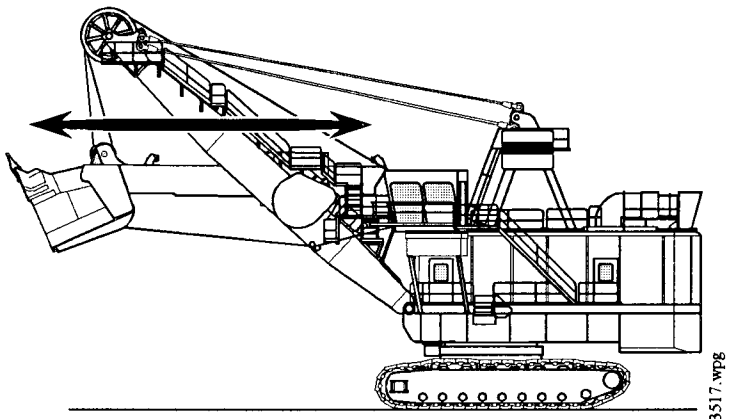
CROWD/L. PROPEL controller or joystick, at the operator's left, controls the crowd machinery to extend or retract the dipper handle through the yoke block in the boom.

CROWD MOTION - From the neutral position, forward movement of the joystick lever extends the dipper handle out, and rearward lever movement retracts it in.

The forward/rearward movement of the joystick controls the speed of the crowd out or retract motion in proportion to the amount the lever is moved away from neutral.

CONTROL TRANSFER





Crowd Motion

PRODUCTION EFFICIENCY

Electric shovels are only as efficient as the operator at the controls. The operator therefore controls machine production within the variables of dipper capacity, swing speed, bail pull, and material density. Other factors such as machine availability time, number of shifts, and fragmentation of material also effect machine production efficiency.

Many operators lose much of their productive efficiency in their inability to control the pit face/floor conditions or the proper spotting of the haul units.