BI379549

BUCYRUS®

49HR

BLAST HOLE DRILL

MAINTENANCE and OPERATION MANUAL

Manual No.
10576
SN: 141287
SN: 141288
SN: 141291

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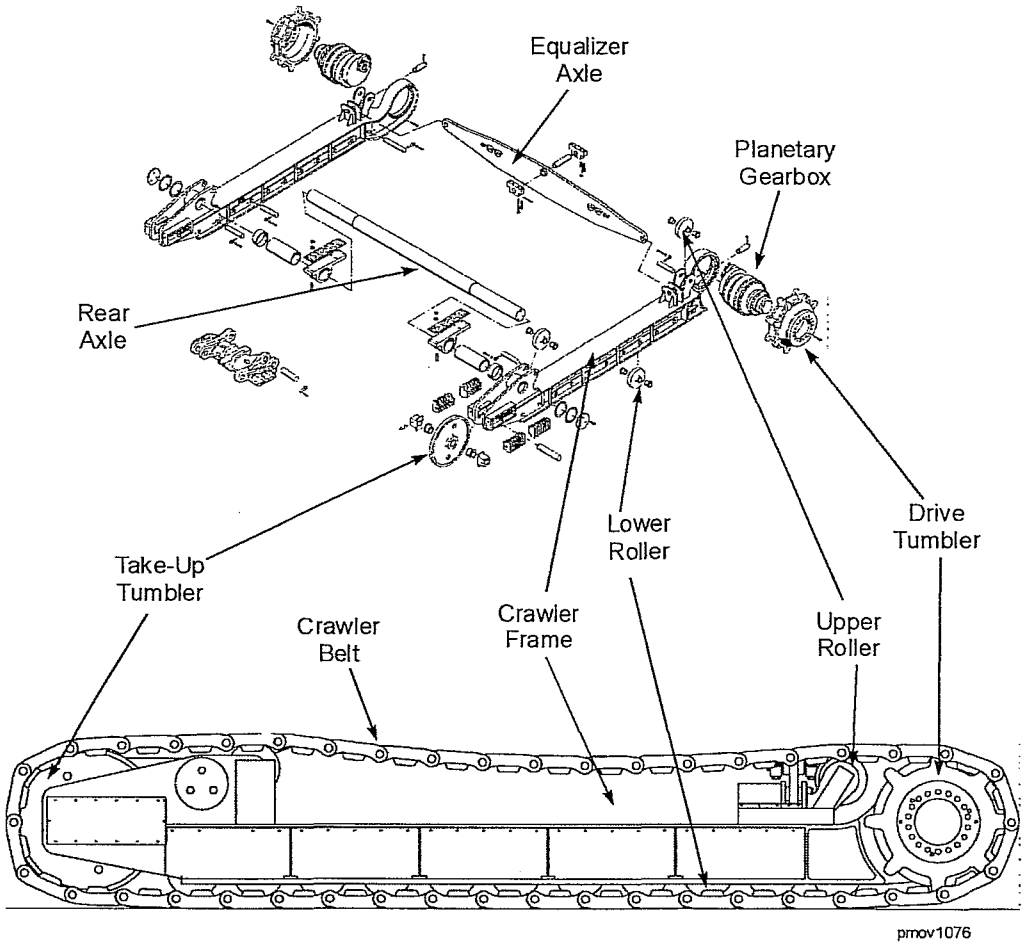
SAFETY PRECAUTIONS

General Precautions:

- The employment of qualified maintenance personnel, through a scheduled maintenance program, is the best way to minimize machine downtime and maximize productivity of equipment.
- Keep hands, feet, and clothing away from rotating parts.
- Wear a hard hat, safety shoes and protective lenses at all times.
- Replace any and all safety and warning placards if they are defaced or removed from the machine.
- Think before you act. Carelessness is one luxury the service man cannot afford.
- Excessive or repeated skin contact with sealants or solvents may cause skin irritation. In case of skin contact refer to the Material Safety Data Sheet (MSDS) for that material and the suggested method of cleanup.
- Inspect safety catches (keepers) on all hoist hooks. Do not take a chance, the load could slip off of the hook if they are not functioning properly.
- If a heavy item begins to fall, let it fall, don't try to catch it.
- Keep your work area organized and clean. Wipe up oil or spills of any kind immediately. Keep tools and parts off of the ground. Eliminate the possibility of a fall, slipping or tripping.
- Floors, walkways and stairways must be clean and dry. After fluid draining operations be sure all spillage is cleaned up.
- Electrical cords and wet metal floors make a dangerous combination.
- Regularly inspect for any loose bolts or locking devices and properly secure them.
- Use extreme caution while working near any electrical lines or equipment whether it be high or low voltage. Never attempt electrical repairs unless you are qualified.
- Check limit switches for proper operation.
- After servicing, be sure all tools, parts or servicing equipment are removed from the machine and secured in an appropriate storage area.
- Mechanical Brakes are designed for use as static holding brakes only. Use as a motion (dynamic) brake in emergency situations only.
- Use proper interior and exterior lighting.
- Install and maintain proper grounding and ground fault protection systems.
- Perform functional tests of all safety circuits.
- Allow electrical inspection and maintenance to be performed only by a qualified electrician.
- Use extreme caution when working around drilled holes.

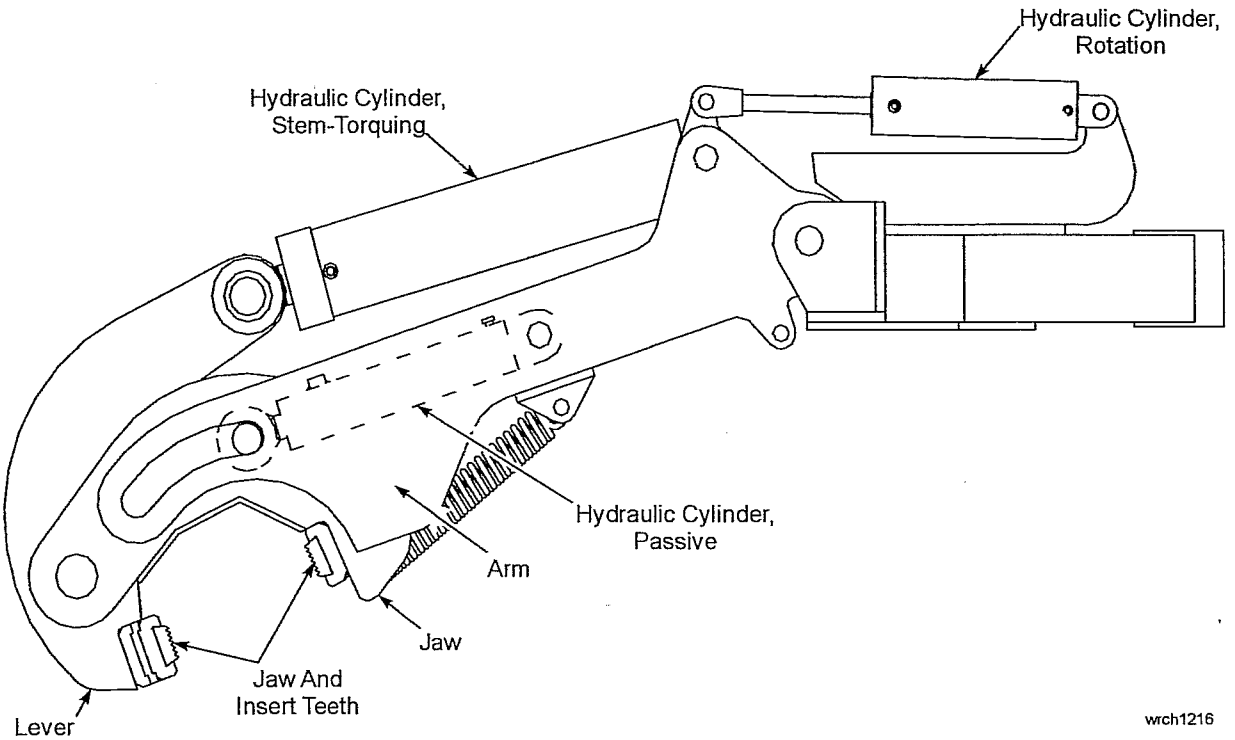
PROPEL MACHINERY

The propel system is a chainless hydraulic drive system which will allow the separate tracks to counter-rotate. This capability provides the machine with the capacity to turn completely around within its own length, but it is not a normal recommended operating procedure. Each track is driven by a hydraulic motor and a planetary gearcase equipped with a hydraulically-released, spring-activated brake. The machine is capable of 2 different propel speed ranges. The lower speed range is used for maneuvering in close spaces while the high speed range is used for tramming in open areas, over long distances.



Propel Machinery

BREAKOUT WRENCH



Section **2**

Operation

Always refer to the safety information in Section 1 of this manual before starting any maintenance procedure on this machine.

Table of Contents

20. Inspect the rotary gearcase for leaks, damaged lines, dirt accumulation and other damaged or missing parts. Check the lubricant level in the gearcase. Fill to the recommended level with an approved gear lubricant. Check the rotary motor ventilation inlets for leaves, paper, rags, etc. blocking the flow of air.

21. Inspect the rotary drive unit for excessive wear or dirt accumulation. Inspect the guide rollers for proper adjustment and excessive wear. Check for loose or missing bolts and bent or cracked structural members.

22. Inspect the pulldown unit for excessive wear or dirt accumulation. Inspect the rack pinions for excessive wear, proper lubrication, and tight retainer bolts. Inspect the guide rollers for proper adjustment and excessive wear.

23. Inspect the pulldown gearcase for leaks, dirt accumulation and other damaged or missing parts. Check the lubricant level in the gearcase. Fill to recommended level with an approved gear lubricant. Check the pulldown motor ventilation inlets for leaves, papers, rags, etc. blocking the flow of air.

24. Check the hoist brake for proper operation.

25. Check the dust or chip deflector for loose or missing parts, excessive wear or dirt accumulation. The deflector should seal around the drill pipe securely.

26. If the machine is equipped with a fire suppression system, perform any applicable checks or inspection as described in the fire suppression system owner's manual.

PRESTART LUBRICATION

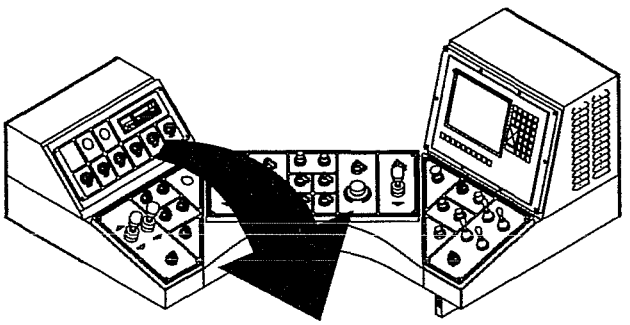
Most machines are equipped with automatic lubrication systems that lubricate most of the necessary points at regular intervals. These systems, although automatic, are not foolproof. Broken lines, dirty lubricant, faulty feeders, and a whole range of other problems can cause wearing parts to loose lubrication. For this reason, it is important that all lubrication points be inspected every shift to verify that they are receiving lubrication. Also, there are several points for lubrication that either need lubrication very infrequently, or are not possible to pipe into the automatic system. These points will need lubrication applied manually.

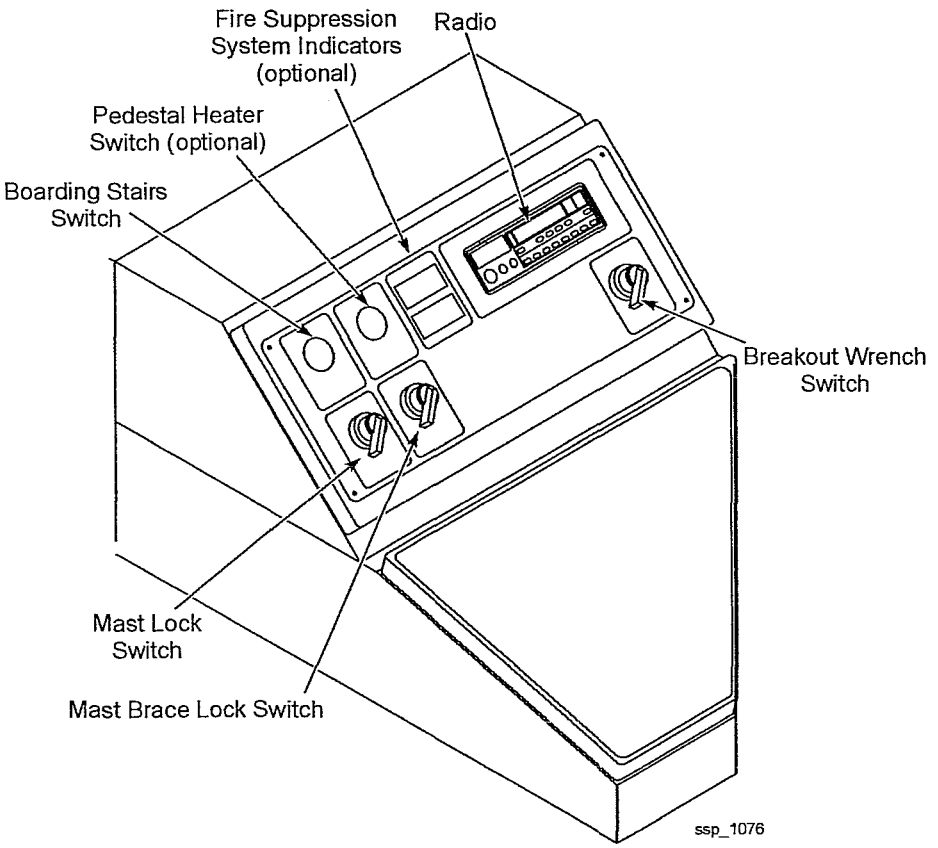
The lube charts in Section 3 ~ *LUBRICATION* give the location and frequency of lubrication.

The lubricant used should be kept clean. If possible the lubricant should be supplied from a bulk lube truck. Be careful when adding lubricant to the automatic system to keep the pump and fill points clean.

When using a manual grease gun wipe each fitting and the grease gun fitting before injecting the lubricant. Use clean containers and funnels for lubricant transferring to the gearcases or reservoirs. Do not allow water to enter any gearcase, reservoir or container. Wipe off all fill caps before removing them.

SELECTOR SWITCH PANEL





MAST BRACE LOCK SWITCH

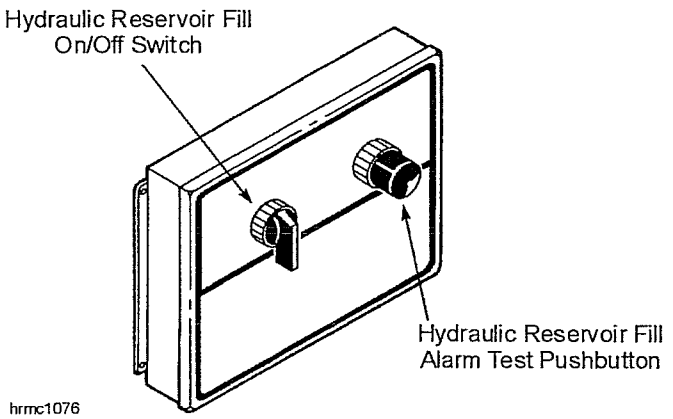
The Mast brace lock switch is a three-position spring-return switch. Turning the switch to the LOCK position will extend the mast brace lock pin cylinder. Turning the switch to the UNLOCK position will retract the cylinder. For this switch to be operable, the hydraulic pump must be running and the mast/winch selector switch must be in the MAST position. This will allow the switch to function in the LOCK position. To function in the UNLOCK position, the rotary head assembly must be at the lower limit point.

MISCELLANEOUS CONTROLS

Located about the machine are various miscellaneous controls and monitors which would be used with optional equipment or do not fit in the previously described groups.

HYDRAULIC RESERVOIR REMOTE FILL CONTROL PANEL

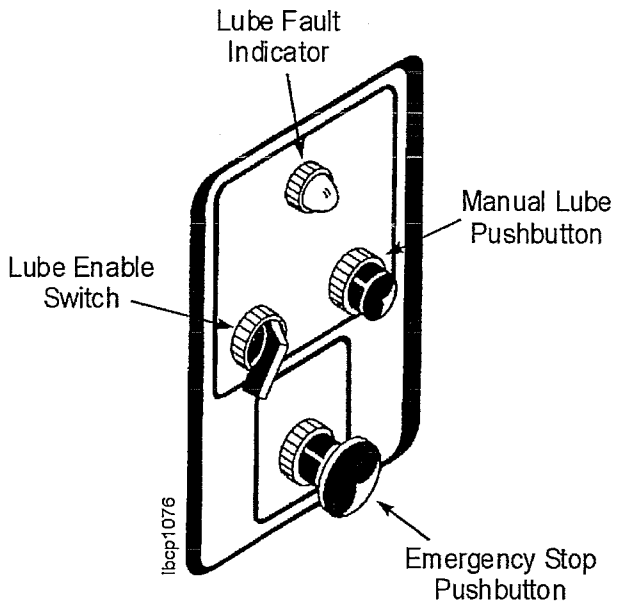
The hydraulic reservoir remote fill control panel is used to monitor the reservoir as it is being filled. The instructions for use of these controls are printed directly below the controls.



Hydraulic Reservoir Remote Fill Control Panel

LUBE CONTROL PANEL

The Lube control panel is located next to the lube pump station in the machinery house and contains the controls as shown.

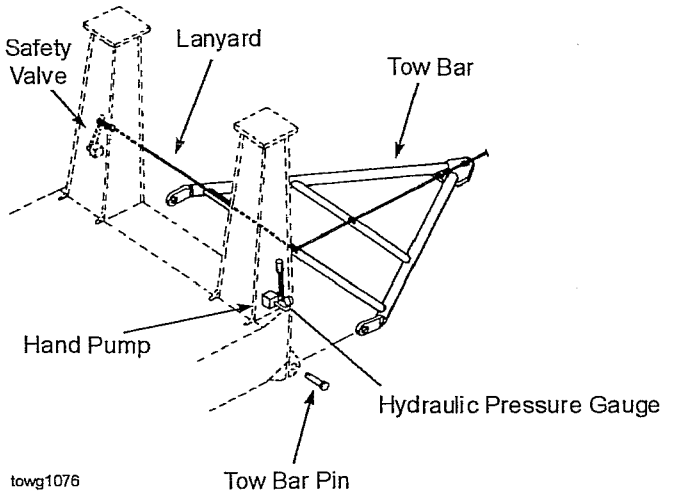


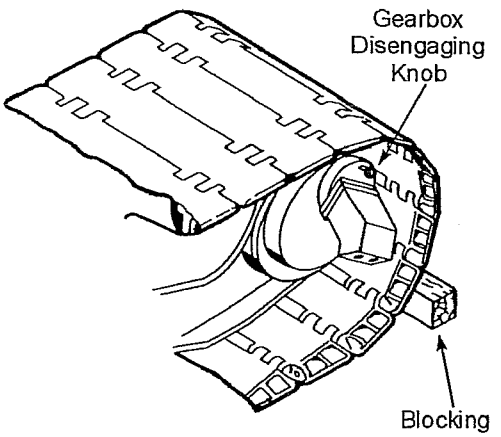
Lube Control Panel

TOWING THE MACHINE

CAUTION: Be sure the crawlers are securely blocked before disengaging the gearcase clutch for towing.

1. Secure the machine by blocking the crawlers.
2. Secure the tow bar to the towing vehicle.





3. Fasten a lanyard to the towing safety valve lever. The valve is mounted to the left front jack casing. Run the lanyard down the casing, along the tow bar and secure it to the towing vehicle. If during towing the tow bar should come loose from either the machine or the towing vehicle, the lanyard will trip the safety valve and set the machine's propel brakes.

4. Disconnect the drive tumbler gearcase from the propel motor as follows:
   a. Ensure that the propel pump controls are in neutral position.
   b. Loosen the shifter lever lock screw.
   c. Pull out the shifter lever to disengage the clutch.
   d. Tighten the shifter lever lock screw.

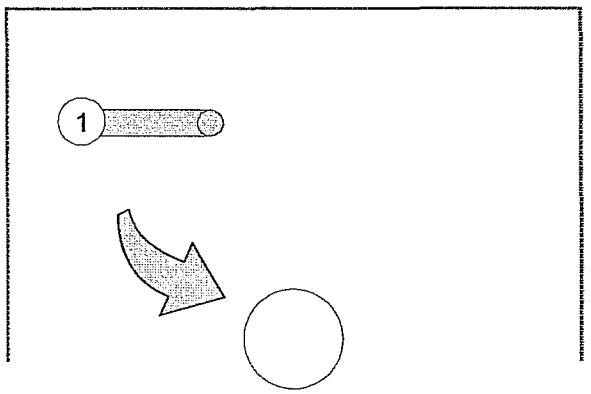
5. Use the hand pump mounted to the right front jack casing. Pump the jack until 1,500 PSI (10,350 kPa) shows on the gauge near the pump.

NOTES:
- Anytime pressure drops below 800 PSI (5,520 kPa), the brakes could drag resulting in premature brake failure.
- Do not tow at speeds greater than 1.1 mph (1.8 kph). Excessive planetary gearcase heating can occur.

6. When towing is complete, reverse the above procedure. The hand pump pressure can be released by turning the release valve on the pump.

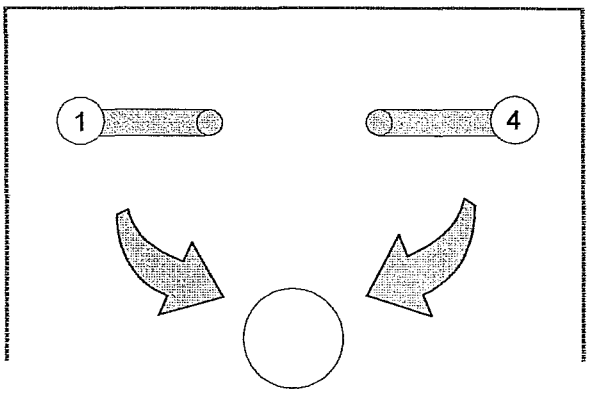
The general method of operating the pipe racks is as follows:

1. Place the operating mode selector switch in the DRILL position. The main air compressor must be energized.
2. Verify that the operating mode selector switch is in the DRILL position and that the hoist/ pulldown speed selector switch is in the PIPE RACK/JOINT position.
3. Select the desired pipe rack.
4. Lift and move the pipe rack joystick, located on the main control panel, out of neutral to perform the desired operation.



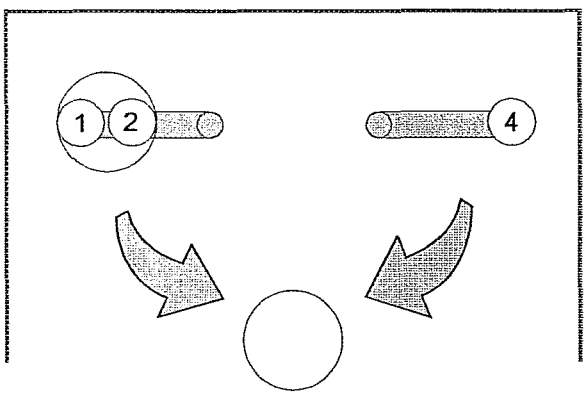
A. Selector Switch in #1 Position
B. Pull Joystick To Swing Out
C. Push Joystick To Store Rack

1 PIPE RACK



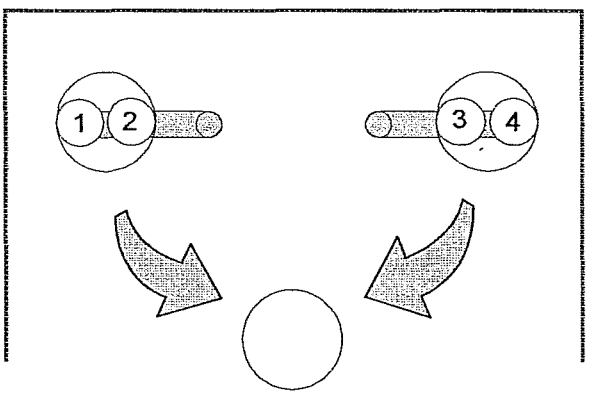
A. Selector Switch In #1 Position - Left Rack or #4 Position - Right Rack
B. Pull Joystick To Swing Out
C. Push Joystick To Store Rack

2 PIPE RACKS



A. For Standard Rack Use Procedure For Right Rack of 2 Pipe Rack Arrangement
B. For Carousel, Use Selector Switch In #1 Position
C. Pull Joystick To Swing Carousel Out
D. Push Joystick To Store Carousel
E. To Rotate Carousel, Put Selector Switch In #2 Position
F. Push Joystick To Rotate The Carousel In One Direction And Pull The Joystick To Rotate The Carousel In The Opposite Direction

3 PIPE RACKS



A. Carousel Operation Is Same As For Carousel For 3 Pipe Rack Arrangement
B. Positions #1 And #4 Of The Selector Switch Control The Swing Out Of The Carousels
C. Positions #2 And #3 Of The Selector Switch Control The Rotation Of The Carousels

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4 PIPE RACKS

6. If the lower tool is the bit, secure the bit with the bit basket as described in the topic BIT REMOVAL. Operate the breakout wrench as described above, except that the lower tool (bit) is secured by the bit basket, not the tool wrench.

DRILL TOOL STRING DISASSEMBLY

The tool string is disassembled in reverse of assembly, that is the bit is removed first, then the drill pipe and lastly the stabilizer.

To remove the bit from the tool string, proceed as follows:

1. Raise the tool string 2 to 3 ft (0.6 to 0.9 m) above the drill deck. Install the bit basket in the hole in the drill deck.

2. Using the breakout wrench, break the joint between the stabilizer and the bit. After breaking the joint, use rotary power to disassemble the joint. Use a slight amount of hoist power to lift the tool string off of the bit to facilitate the disassembly.

3. Hoist the tool string 2 to 3 ft (0.6 to 0.9 m) off of the drill deck. Secure the rotary/pulldown unit and controls. Attach a lifting bell to the bit. Attach the auxiliary winch line to the lifting bell and lift the bit out of the bit basket.

4. After removing the bit, a new bit may be installed or the bit basket may be removed, allowing removal of the drill pipe.

To remove the drill pipe from the rotary drive unit, proceed as follows:

1. Lower the tool string until the slots on the upper end of the stabilizer are aligned with the tool wrench. Clamp the stabilizer in the tool wrench. Using the breakout wrench to break the joint between the stabilizer and the drill pipe. After breaking the joint, use the rotary unit to disassemble that joint completely. Raise the rotary/pulldown unit and drill pipe 2 to 3 ft (0.6 to 0.9 m).

2. Press the drill/propel control OFF push-button and set hoist brake. Go to the drill deck and clean the pocket of the pipe rack to be used of dirt, cuttings or any material that will interfere with the entrance of the pipe or the operation of the pipe rack gate controls. Verify that the gate controls are intact.

3. Clean and lubricate the threads and shoulder on the lower end of the pipe. This is to prevent rusting while stored in the pipe rack. After performing this function, return the controls to operating condition.

5. Release the hoist brake and allow the drill bit to contact the ground. Monitor the vibration coming from the tool string. To reduce vibration slow the rotary speed with the rotary rheostat. Keep the vibration to a minimum. As the vibration lessens, increase the rotary speed and the pulldown speed while monitoring the rotary current and the air pressure bar graph on the operator's display terminal screen.

The objective is to penetrate the formation as fast as possible without damaging the machine or plugging the hole with cuttings. Monitoring the rotary current, and keeping the load in the lower portion of the bar graph (green) will eliminate damage to the rotary motor. Reducing the load on the motor is accomplished by reducing the pulldown force on the bit. In some cases it may even be necessary to hoist the tool string slightly to reduce the loading.

Monitoring the air pressure bar graph will indicate the condition of the hole. If penetration is too fast and the bailing air cannot remove the cuttings as fast as they are generated, the hole will plug and the air pressure will rise. Varying the penetration rate will vary the air pressure. Keep the air pressure in the normal working range (45 PSI for machines with water injection and 50 PSI for machines with dry-type dust control) by increasing or reducing the penetration rate. Keep the vibration levels to a minimum by varying the rotary speed and the pulldown force.

6. When the bit passes through the fragmented material (approximately 3-5 Ft. [0.9-1.5 m]) and into the consolidated material underneath, the vibration and rotary current will reduce drastically. When this occurs, the hole has been collared and normal drilling may commence.

NORMAL DRILLING

After the bit has passed through the unconsolidated material at the top of the hole, it is no longer necessary to reduce the load on the bit to reduce vibration and rotary motor loading. More rapid penetration and increased pulldown force may now be used to complete the hole as fast as possible with minimum vibration. This is the normal drilling condition for the machine.

Normal drilling follows the same guidelines as collaring the hole. Penetration is increased to the maximum determined by the rotary motor load, the vibration of the tool string, and the air pressure. By keeping the penetration at or slightly below the optimum, the hole can be completed in the shortest possible time.

To begin normal drilling proceed as follows:

1. Normal drilling requires added pressure to the bit in addition to the deadweight of the tool string and rotary/pulldown unit. This pressure is furnished with the electric motor and pulldown gearcase. To activate the pulldown motor, turn the hoist/pulldown rheostat in the pulldown direction as required for maximum drill rate and pulldown force. Turning the control in the pulldown direction will increase the pressure on the bit by calling for a desired pulldown speed.

NOTE: If the machine is to be lowered manually, refer to steps 4, 5 and 6 and operator's display terminal auto leveling screen.

4. Using the manual leveling jack controls, lower the machine, so that it remains level, until it is touching the ground. Use the leveling jack controls in pairs (i.e. either both side controls, or both end controls simultaneously) to reduce the twisting loads on the drill frame.

5. Once the machine is touching the ground, first lower the uphill side or end of the machine to the ground, then lower the downhill side or end to the ground. It is important that the machine be lowered in stages to minimize both the angle of the machine and the bending stresses placed on the machine.

CAUTION: While manually lowering the machine to the ground it is imperative that the machine be kept as level as possible. It may be necessary to lower the machine in stages to keep it as level as possible.

6. Once the machine is completely lowered, retract the leveling jacks to the maximum retracted position.

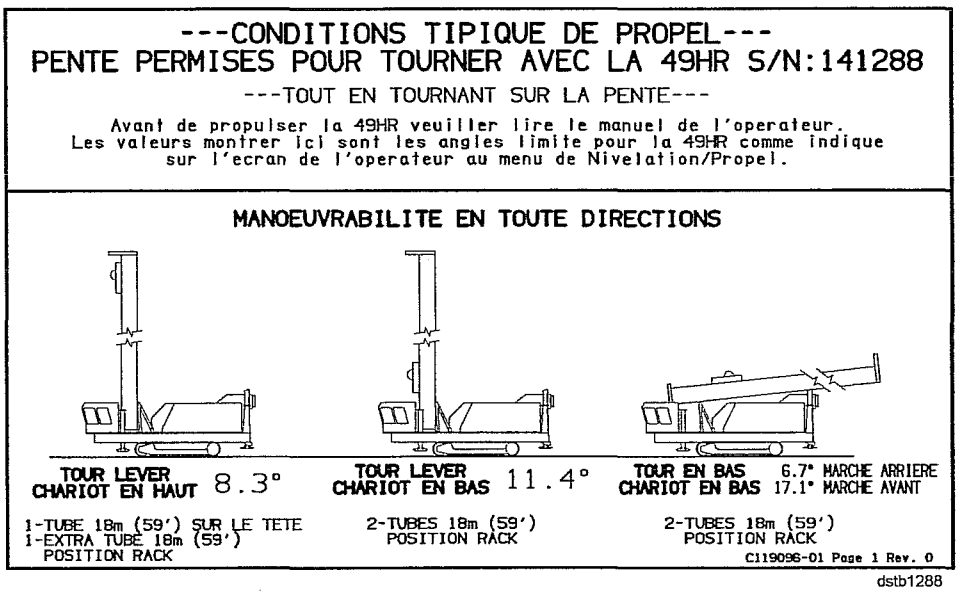
CAUTION: When manually lowering the machine be sure that the leveling jacks are fully retracted before propelling the machine. Propelling the machine with a leveling jack not fully retracted will result in serious damage to the jack and machine structures.

7. Inspect the machine travel route as outlined in *PROPELLING* in this manual. After completing the inspections the machine is ready to propel.

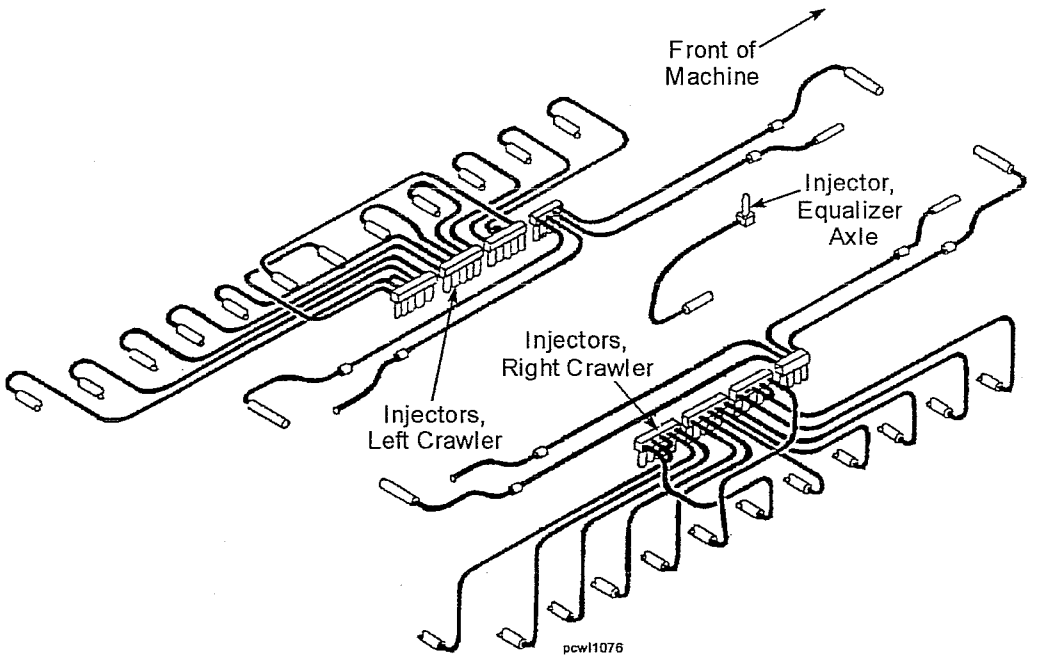
MACHINE SHUTDOWN

Shutting down the machine is necessary any time that the operator must leave the machine, either at the end of the shift, or for a period of time during the shift. Machine shutdown is also necessary for most maintenance work to be performed.

Shutting down the machine is essentially the reverse of starting it up. The degree of storage work to be done is determined by the length of time the machine will be shut down. Shutting down for a short period involves little extra work, while shutting down for a lengthy period will involved considerable effort.



Drill Stability Chart~141288 - Part 4



Auto Lube Piping ~Crawlers

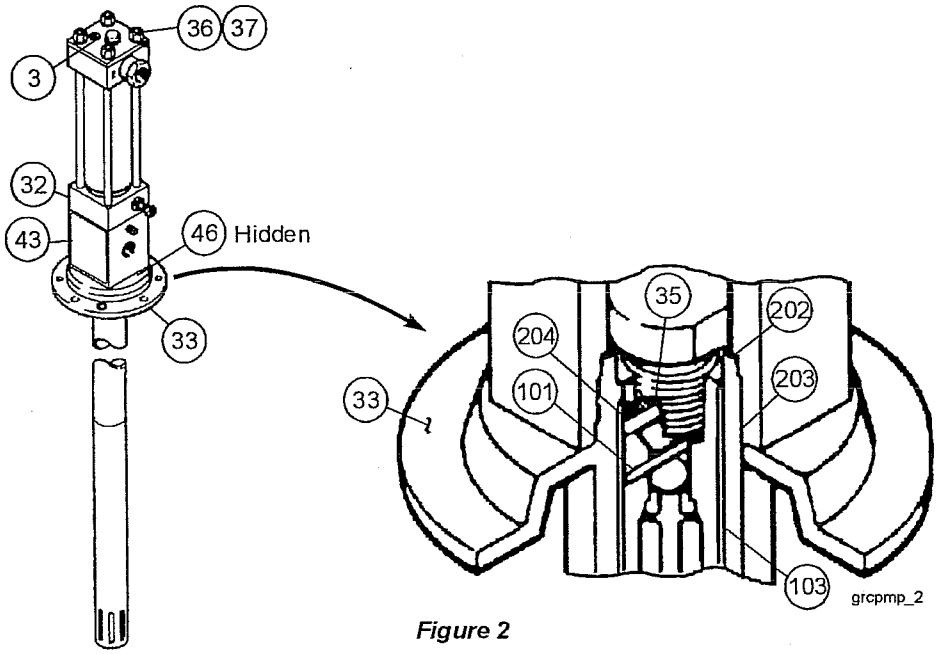


Figure 2

6. Pull the connecting rod (35) down as far as it will go. Remove the cotter pin (204).

NOTE: For the 35 in. length pump, the priming cylinder and the priming piston must be completely removed before you can pull down the displacement cylinder far enough to remove the cotter pin (204).

7. Unscrew the piston coupling (103) to remove the pump.

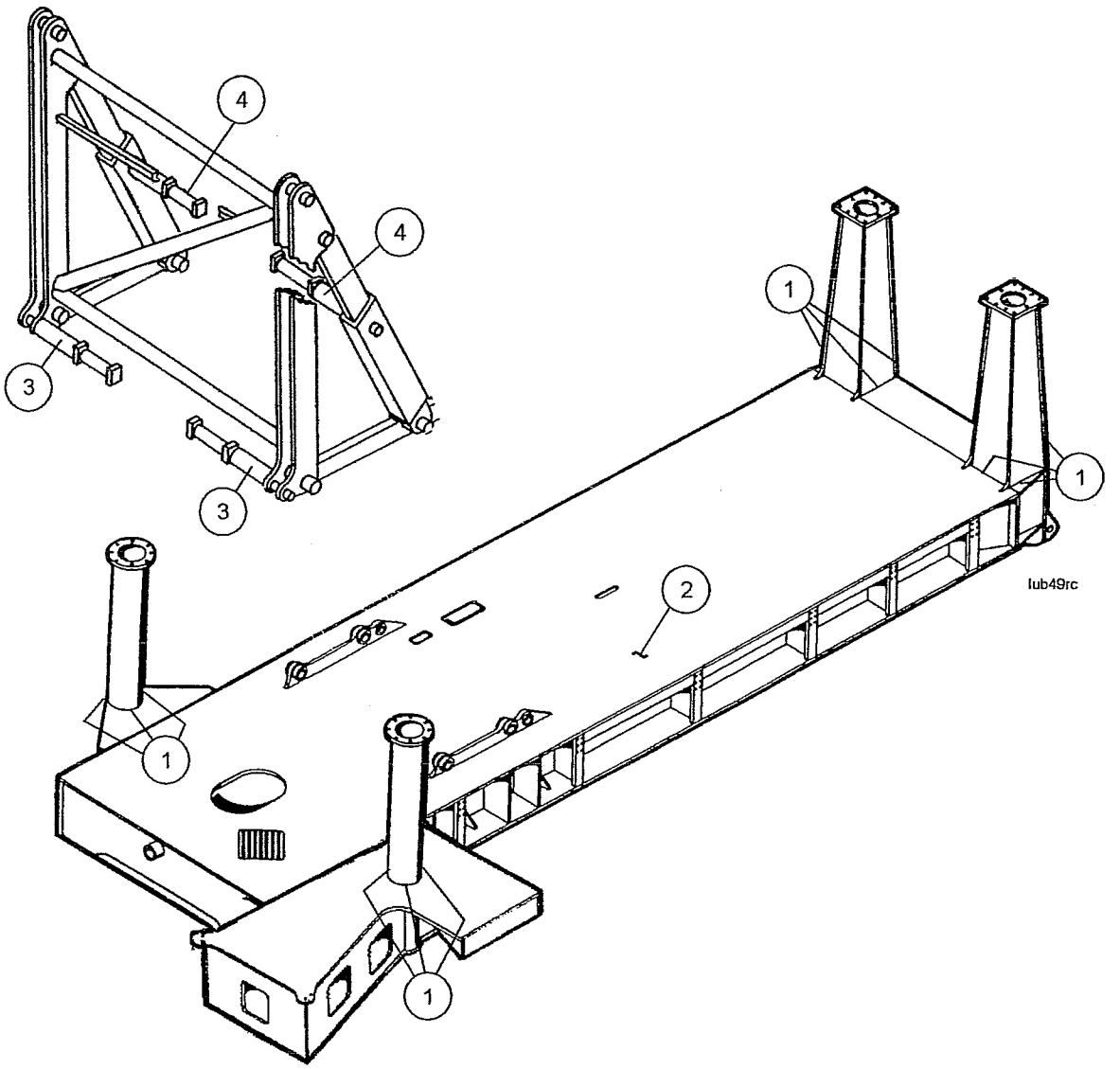
RECIPROCATOR REPAIR

NOTE: Clean and inspect all parts for wear or damage. Replace parts as needed. For the best results, always replace all the O-rings and seals when you disassemble the pump. A repair kit is available.

NOTE: Assembly tool 181–619 is required for reassembling the reciprocator.

NOTE: For the following step 12, Loctite® 242 thread sealant and Loctite Primer T or Perma-Loc® 115 thread sealant and Perma-Bond® Surface Conditioner I are required. Be sure their shelf-life is within the manufacturer's recommendations.

1. Loosen both nuts on the fluid tube. Use a wrench to rotate the tube fittings to the side, and then remove the tube. Check the O-rings on the fittings and replace them if they are worn or damaged. Install plugs in the fittings to prevent contamination.



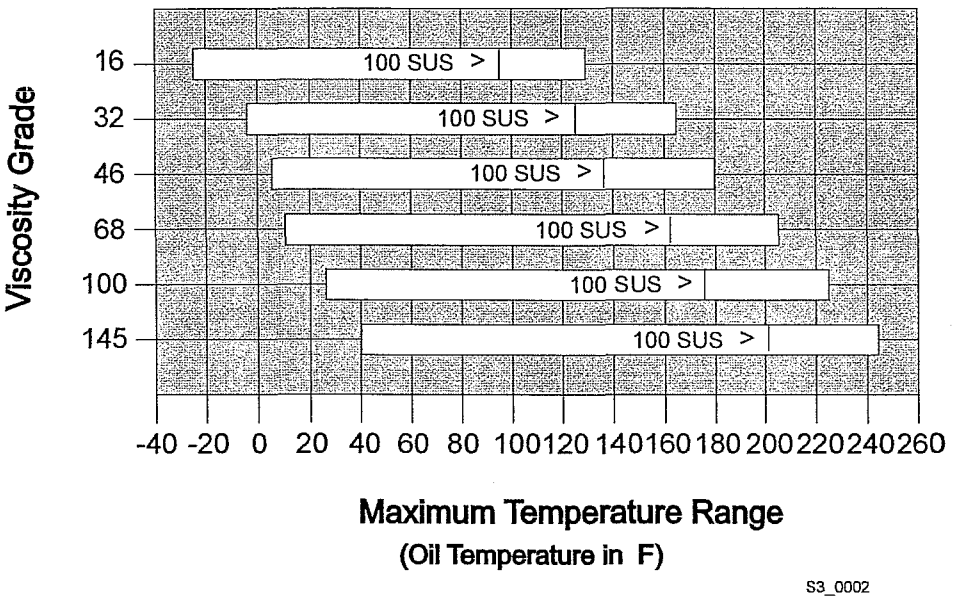
MAIN FRAME LUBRICATION

LUBE POINT	NO. OF POINTS LUBRICATED	TYPE LUBRICANT	HOURS 8	40	160	1000	AS REQ.	AUTO	COMPONENTS
1	12	MPG	X					X	LEVELING JACK CASING - LOWER
2	1	MPG	X					X	EQUALIZER AXLE CENTER PIN
3	2	MPG	X					X	MAST LOCK PINS
4	2	MPG	X					X	A-FRAME LOCK PINS (OPTIONAL)

NOTES: The above frequencies are for manual lubrication. When equipped with an automatic lube system the frequencies are set at the lube control station.
On automatic lube systems the injectors should be set at full opening at start-up of a new machine and then readjusted as required. Refer to LUBRICANT INJECTORS in this section of the manual.

6. Oxidation Hours to 2.0 Neutralization Number per D-943 = 1,500 hours minimum.

7. Demulsibility (easy separation from water) per D-1401 = 30 ±15 minutes to 3 ml. max. of emulsion.



Recommended Viscosity vs. OAT Chart

CAUTION: In general, water will not separate from motor oils or automatic transmission fluids, therefore these fluids are NEVER recommended as hydraulic system fluids.

8. Hydrolytic Stability per D-2619 = Copper wt. loss not to be more than .50 mg/cm^2

The oil should contain rust and oxidation (R+O) inhibitors and foam depressants.

CAUTION: The use of water or glycol base or *any* other fire resistant fluid is prohibited since serious damage to the hydraulic system will occur which will void the warranty on the machine hydraulic system.

Obtain oil from a reputable supplier. Contact the Bucyrus Service Department for specific oil recommendations or approval.

MAINTENANCE INSPECTION CHECK POINTS

DAILY

EXTERNAL INSPECTION

1. Check areas around and under the machine for signs of water or lubricant leaks. If single droplets of water or lubricant are noticed, leakage is minimal. Determine the source of the leak and make note of it on the log sheet. If pooling of water or lubricant is noticed, determine the source and take remedial action immediately.

2. Inspect the crawler belts for broken or cracked pads, missing lock pins, loose track pins, and proper crawler belt tension.

3. Check the drive tumbler gearcase, hydraulic motor and hoses for leaks. Check the lubricant level in the drive tumbler gearcase.

4. Inspect the crawler frames for cracks and dirt or ice buildup. Check the rollers and tumblers for proper lubrication, free operation, and dirt or ice buildup. Check axle attachment pins and bolts.

5. Check the dust curtains for tears. Be sure that the curtains are not frozen to the ground or covered with cuttings.

CAUTION: **The machine trail cable carries a lethal voltage. Handle the cable in an approved manner with approved rubber gloves and insulated hooks or tongs.**

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Blast Hole Drill

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ITEM #	NOTED DISCREPANCY

Date: _____

Shift: _____

Inspected By: _____

Supervisor: _____

100 HOURS, OR WEEKLY *(cont.)*

25. Check the leveling jacks for oil leaks.
26. Check the mainframe for cracking.
27. Check the retractable stairway for proper operation.
28. Check the outside of the machinery house and cab for damage or cracking.
29. Check that all blowers for ventilating and radiators are not obstructed.
30. Check dry-type dust collection unit duct and hoses for leaks.
31. Lube drive shaft bearings on dry-type dust collection unit.
32. Check that water tank is full.
33. Check the condition of the mast braces and brace pins.
34. Check the mast brace lock cylinders and hydraulic lines for leaks.
35. Check that the mast hoist cylinder pins and retaining pins are in place.
36. Check the mast structure for wear, damage or cracking.
37. Check the mast's racking for wear, damage and lubrication.
38. Check the mast ladder, safety guards and platforms for cracking and missing bolts.

49HR
Blast Hole Drill

pmc_59r

ITEM #	NOTED DISCREPANCY

Date: _____

Shift: _____

Inspected By: _____

Supervisor: _____

The most common problem encountered with lower rollers is bushing wear. However, over a period of time, the rollers will wear and possibly develop cracks. The cracks may be repaired by gouging and welding. Refer to the welding instructions in Section 9 ~ *ENGINEERING DATA*.

If bushing replacement is necessary, the roller must be removed from the machine. To accomplish this:

1. Relieve the crawler belt tension as described in *CRAWLER BELT ADJUSTMENT*.

2. Using the machine leveling jacks, raise the machine sufficiently to allow removal of the roller. Block the machine in the raised position. It may be necessary to jack the crawler belt away from the crawler frame and block in position to remove the extreme front or rear rollers.

3. Remove lubrication guards and lube lines, if so equipped, to gain access to the roller shaft.

4. Remove the capscrew and retainer securing the lower roller shaft to the crawler frame.

5. Support the lower roller with suitable blocking. Remove the roller shaft.

6. Remove the blocking and lower the roller out of the crawler frame.

7. Inspect the roller bushing. Remove and replace the bushing if necessary. Inspect the lower roller shaft. Replace if worn. Inspect the crawler frame in the area of the lower roller. Repair shaft bore or thrust surfaces if necessary.

8. Lubricate the roller bushing and shaft. Install roller in crawler frame and block in line with the shaft bore.

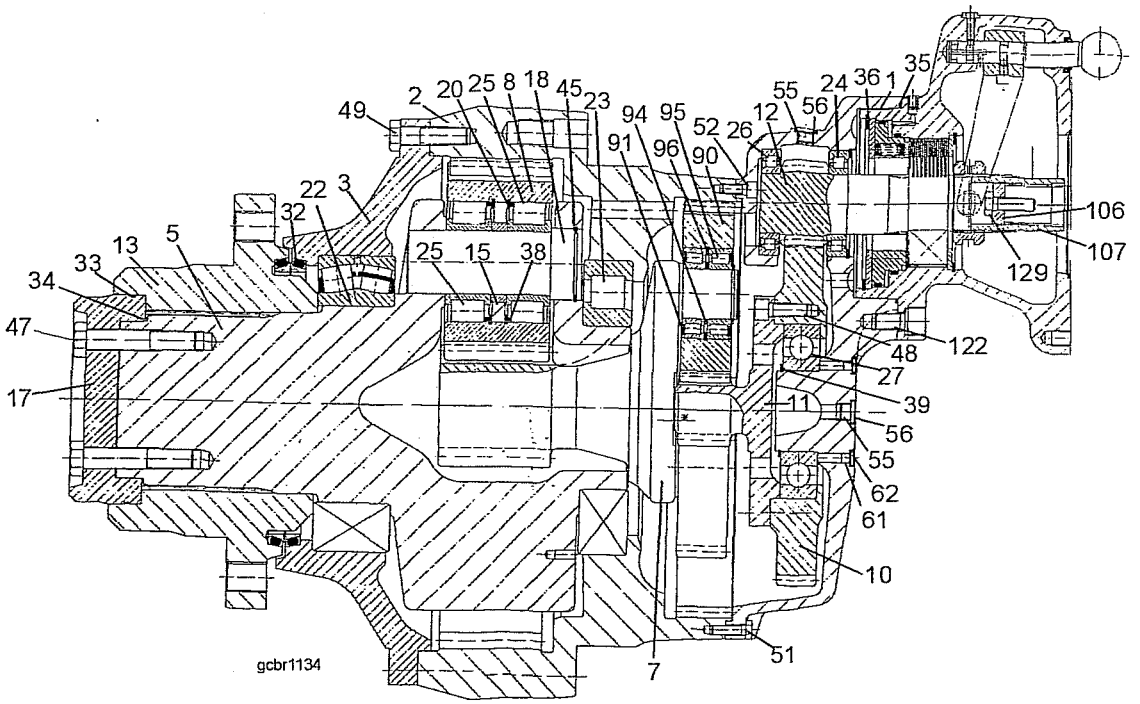
9. Insert the roller shaft.

10. Install the retainer and capscrew to secure roller shaft to crawler frame. Remove the roller blocking.

11. Install and adjust lubrication guards and lube lines if so equipped.

12. Adjust belt tension as described in *CRAWLER BELT ADJUSTMENT*.

13. Remove blocking and lower machine. Propel the machine to distribute the lubricant evenly in the roller and check roller operation.



Propel Gearcase and Brake

1. Housing
2. Gear, Twin Ring
3. Ring, Support
5. Stage, Planet First
7. Carrier, Planet
8. Stage, Planet Output
10. Gear, Spur
11. Shaft, Sun Gear
12. Shaft, Input
13. Hub, Sprocket
15. Spacer
17. Plate, Retaining
18. Pin, Planet
20. Ring, Locating
22. Bearing, Spher Rlr
23. Bearing, Cyl Rlr
24. Bearing, Cyl Rlr
25. Bearing
27. Bearing, Ball
32. Seal, Face
33. O-Ring
34. O-Ring
35. O-Ring
36. Ring, Snap
38. Ring, Snap
39. Ring, Snap
45. Ring, Snap
47. Bolt, Hex Head
48. Bolt, Socket Head
49. Bolt, Hex Head
51. Bolt, Hex Head
52. Bolt, Socket Head
55. Plug, Screw
56. Ring, Seal
61. Plug, Screw
62. Ring, Seal
90. Gears, Planet
91. Bearing
93. Ring, Locating
94. Ring, Locating
95. Ring, Snap
96. Bearing
106. Plate, Retaining
107. Coupler
122. Bolt, Socket Head
129. Bolt, Hex Head

OIL SEAL INSTALLATION

Refer to the figure below and install oil seals as follows:

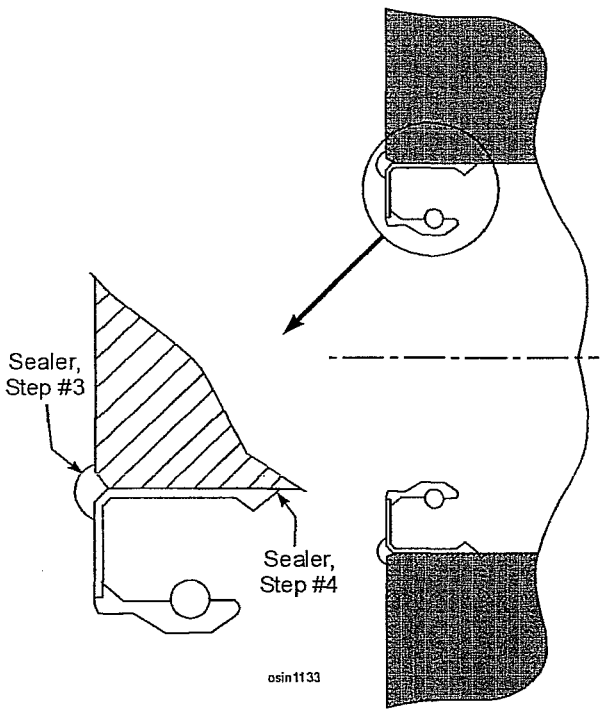
1. Clean mating surfaces of dirt, oil and grease.

2. Spread a thin layer of silicon sealer over the entire outside seal diameter.

3. Spread the silicone sealer evenly at the space between the exterior seal diameter and the seal bore after pressing the seal.

4. The sealer that accumulates along the interior fills the space like a fillet. It is important that this is only a small amount.

5. The oil seal must be installed square with the shaft. When the oil seal is at an angle with the shaft, it will sweep oil out of the gearcase.



7. Place the open end of the above hose into an empty 5 gallon pail and reattach the female half of the quick-disconnect to the male half that is still attached to port PR. When the quick disconnect opens, a stream of oil from the rod side of the cylinder will exhaust from the 1/4 inch hose into the pail. This will allow the jack pad to lower by gravity to the ground. The oil will stop flowing.

8. Again remove the female quick-disconnect half with the hose as in step 5 and reconnect the hose onto the port of the electric junction box.

9. For front jack repair, uncouple the quick-disconnect at both front jacks, using a 1-1/4 inch open-end wrench. The male half of the quick-disconnect will remain attached to the valve.

10. At just one front jack remove the other end of the quick-disconnect hose from the electrical junction box on the jack.

11. Place the hose end, removed from the electrical junction box, into a clean five gallon container. (Two additional 5 gallons will be required to handle the oil from both front jacks.)

CAUTION: ALWAYS MAINTAIN A FIRM GRIP ON THE HOSE WHILE THE OIL IS FLOWING FROM IT. Do not allow the stream of oil to contact skin as injury can occur.

12. Re-couple the quick-disconnect. As the connection nears completion, oil will run out of the hose-end in the container and the jack pad will drop to the ground. This will relieve all pressure on the piston rod and create a vacuum on the housing-end of the cylinder.

13. A helper will be required to remove the oil from the other front jack. While one person continues to hold the disconnected hose into an empty 5 gallon container, the other re-couples the quick-disconnect on the other front jack. The oil from this jack will now flow from the hose being held.

14. When the oil flow has stopped and the jack pad is on the ground, the loose end of the hose can be reconnected to the electrical junction box.

15. Remove the male half of the quick-disconnect from port PR and thread it loosely into the female half. Cover the open end with a protective cap.

16. Remove the 3/8 inch hose at the counterbalance valve and plug the open end of the hose.

17. Insert a SAE-6 steel O-Ring boss plug into ports PR and PH.

18. Remove the casing cover bolts.

NOTE: If one of the front jacks is to be repaired, the mast brace support must be removed and an eyebolt installed in the cover for removal purposes.

1. Securely block the gearcase in the upright position. Remove the rotary motor from the gearcase. Refer to *ROTARY MOTOR*. Drain the oil from the gearcase. Remove the motor adapter ring. Remove the motor O-Ring from the gearcase.

NOTE: If the drive unit is left on the machine, lower it to the bottom of the mast and rest it on the lower stops. Shut off and tag the controls.

2. Remove the air pipe and gasket from the swivel housing.

3. Remove the gearcase front cover and gasket.

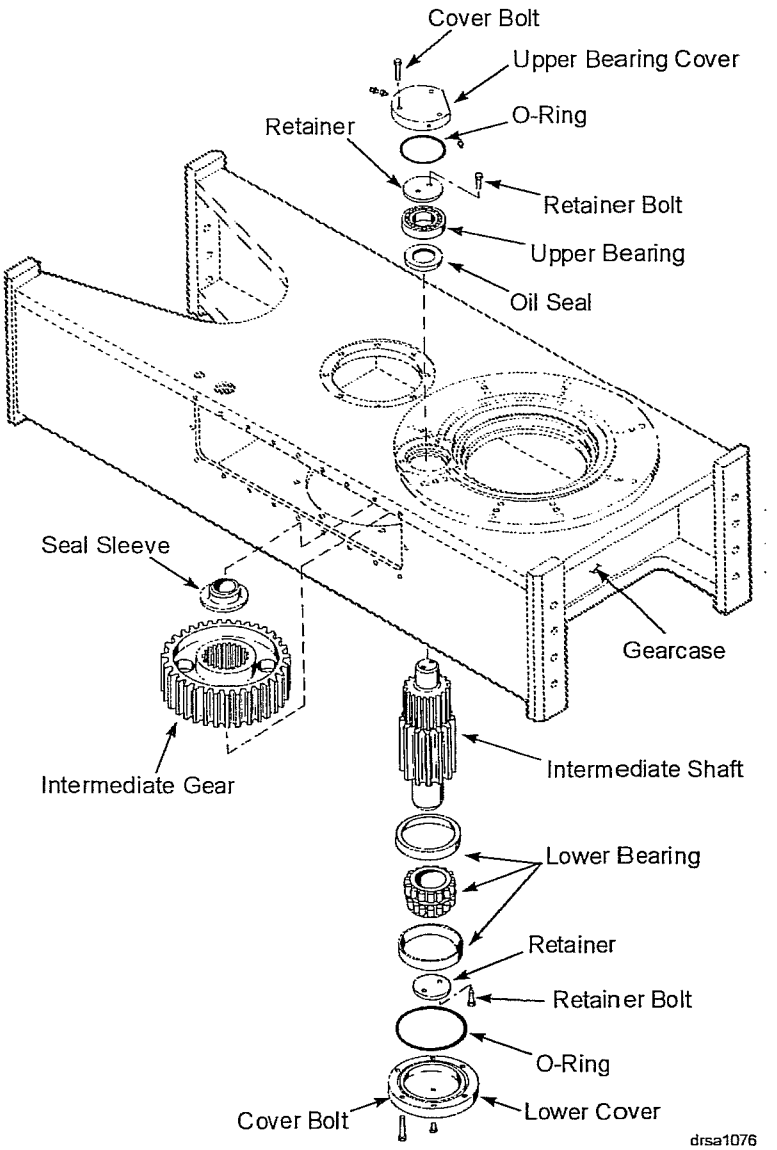
4. Remove the intermediate shaft upper bearing cover and cover O-Ring. Remove the upper bearing retainer.

5. Install an eyebolt into one of the tapped holes in the top of the intermediate shaft. Support the shaft with rigging and a crane.

6. Support the intermediate gear with blocking so that when the shaft is removed the gear will not fall.

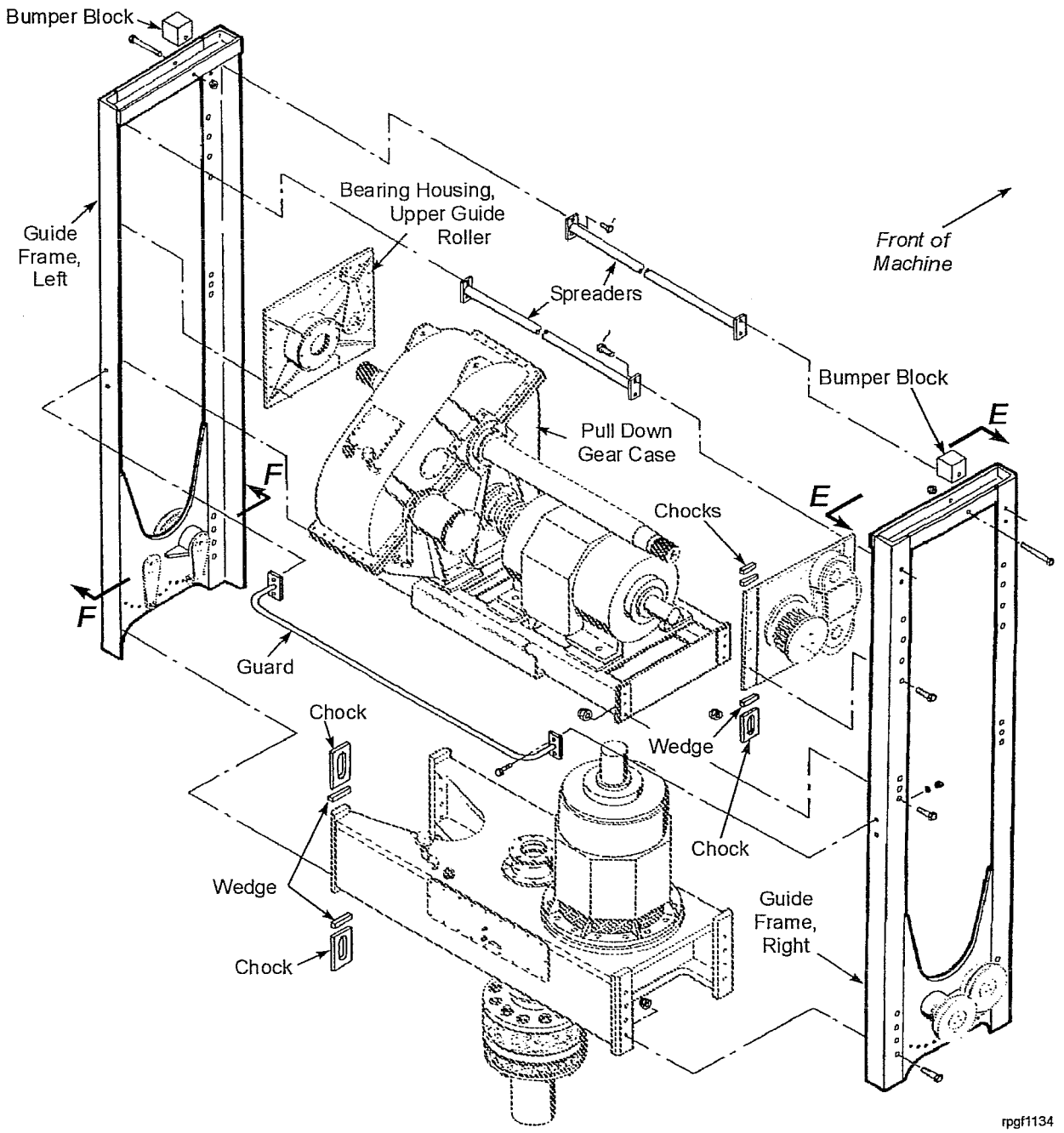
7. Remove the capscrews securing the lower bearing retainer to the gearcase. Remove the bearing retainer. Remove the O-Ring from the retainer.

8. Slowly lower the intermediate shaft out of the gearcase. Remove the lower bearing, retainer, and spacer from the shaft. The lower bearing has an interference fit of .0005 - .0025 inch to the shaft.



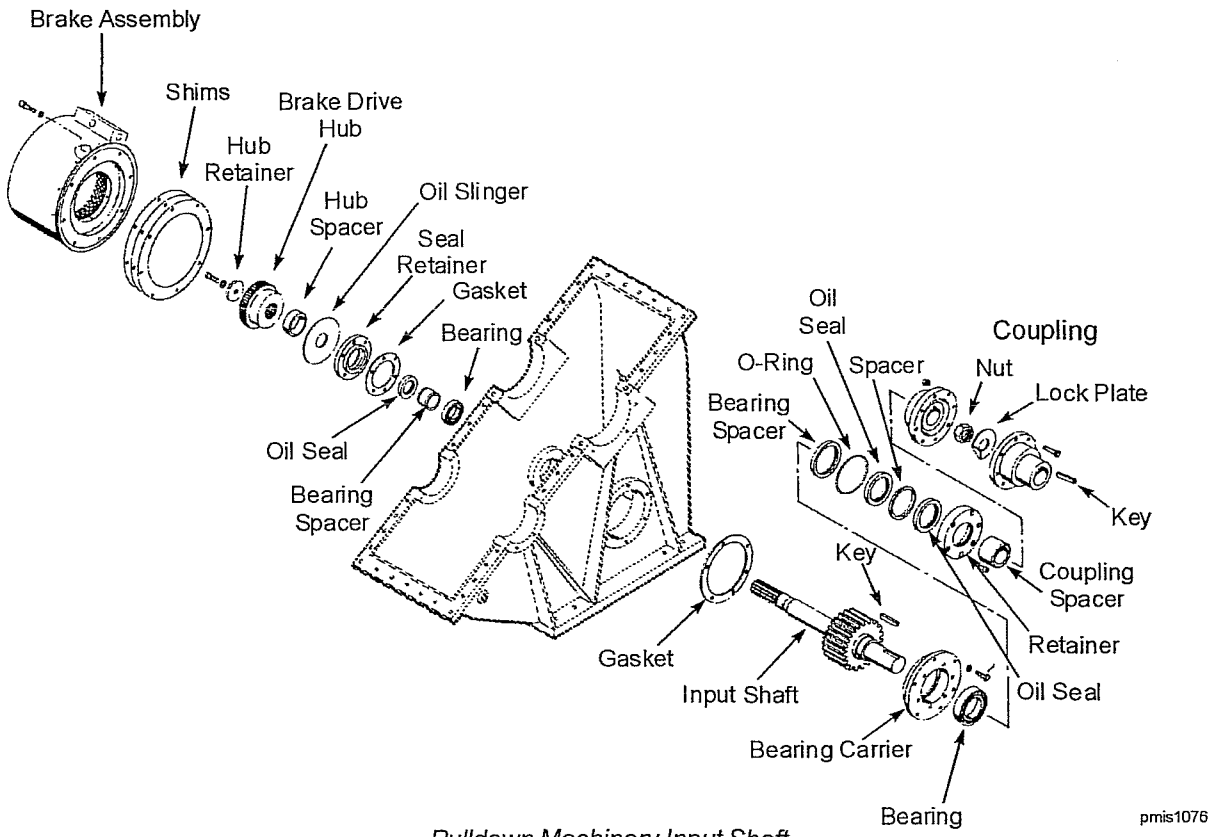
NOTE: The inner race of the upper bearing has an interference fit of .0006 - .0017 inch to the shaft and may require a slight force to separate it from the shaft.

ROTARY/PULLDOWN GUIDE FRAME



CAUTION: UNEXPECTED OPERATION OR MOVEMENT OF THE PULLDOWN UNIT AND/OR ROTARY GEARCASE DURING SERVICE OR INSPECTION PROCEDURES CAN CAUSE SEVERE PERSONAL INJURY OR DEATH. Lower the pulldown unit to its lowest possible position or secure it in place. Lockout and tag controls to prevent unexpected operation.

The rotary guide frame assembly consists of two frames that support the rotary machinery and the pulldown machinery. The guide frames also include the guide rollers which are used to align and secure the guide frame assembly to the mast.



Pulldown Machinery Input Shaft

19. Remove the brake housing and cage mounting capscrews. Slide the brake assembly from the brake drive hub. Disassemble the brake as covered under *HOIST BRAKE*.

20. Remove the brake drive hub retainer capscrew and retainer. Remove hub, hub spacer and oil slinger.

21. At the coupling end of the shaft remove the bearing carrier capscrews. Slide the shaft assembly from the gearcase. Remove the carrier gasket.

22. Remove spacer and bearing from the brake end of the shaft. The spacer and bearing are interference fit to the shaft and will require a slight force for removal.

23. Use a puller to remove half coupling from the end of the shaft.

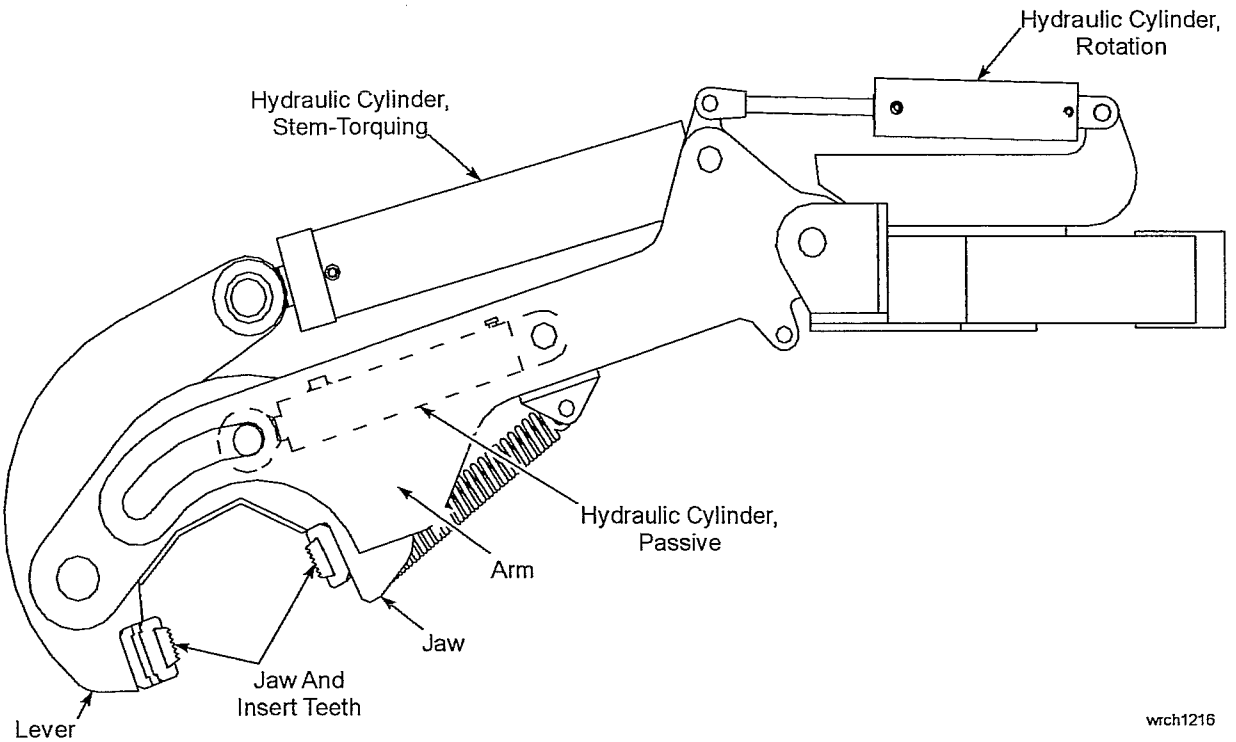
24. Remove seal retainer from bearing carrier. Remove O-Ring, oil seals and seal spacer from the retainer.

25. Remove the bearing spacer and coupling spacer. The coupling and bearing have an interference fit to the shaft and will require a slight force for removal. Remove the carrier and bearing as an assembly, then separate them.

BREAKOUT WRENCH

The breakout wrench is used to break pipe joints that will not break using the rotary drive.

With the pipe secured by the tool wrenches, the breakout wrench switch is turned to and held in the EXTEND position. The breakout wrench extends, grips the pipe, then turns, breaking the pipe joint.



REPAIR

The breakout wrench should be inspected daily for wear or damage, loose or missing hardware, and proper operation. Repair of the breakout wrench is limited to the replacement of worn or damaged components.

GENERAL GUIDELINES FOR DISASSEMBLY

1. Remove attachment pins to remove hydraulic cylinders.
2. Remove pin to dismount lever.
3. Remove pins to dismount jaws.
4. Remove pins to sidemount arm. Check for excessive wear on brass washers.
5. If jaw replacement is necessary, teeth or jaw inserts must be removed. Softly strike the tooth to take it out.
6. Reinstall in reverse order, except for cotter pin.
7. Check the operation of the wrench. If the inserts contact the pipe, wrench is ready for use. If inserts do not contact the pipe, repeat steps.

10. Clean and inspect all parts. Repair or replace all damaged or worn parts and reassemble in reverse of disassembly, noting the following:

    a. When reassembling the gearcase, use new seals, gaskets and bolts.

    b. Use Locktite® 262 on all bolts and tighten all bolts to 200 Ft.Lbs.

    c. When installing gearcase coupling, proceed as follows:

        1. Verify that the motor shaft is centered.

        2. Mount the coupling hubs on the motor and gearcase.

        3. Mount the gearcase so that a .51 inch gap exists between the ends of the shafts.

        4. Check the coupling for angular and offset misalignment. Maximum misalignment should not exceed .002 inch. Use shims under the gearcase feet to correct misalignment.

        5. Tighten the coupling capscrews (dry threads) to 30 Ft.Lbs.

2. With the pumps running, energize the Propel Active Valve (PAV). Note the presence of 600 PSI at test port 59. Operate the left crawler control in the FORWARD direction by manually pressing coil PLV-FWD. Adjust the relief as required to 5,400 PSI on gauge at test port 1.

3. Maintain step 1. Place the left crawler control in the REVERSE direction by manually pressing coil PLV-REV. Adjust pressure as required to see 5,400 PSI at test port 2.

4. With the machine raised on jacks and a 7,500 PSI gauge at test ports 3 and 4, check the main relief pressures on the right crawler pump.

5. With the pumps running, operate the right crawler control in the FORWARD direction by manually pressing coil PRV-FWD. Adjust the main relief valve as required to 5,400 PSI on the gauge at test port 4.

6. Repeat step 5 except place the right crawler control in the REVERSE direction by manually pressing coil PRV-REV. Adjust the pressure as required to 5,400 PSI at test port 3.

7. Reconnect the propel brake release hoses that were disconnected in step 1.

8. De-energize Propel Active Valve (PAV).

Crawler Function:

NOTE: Check that the crawler gearcases have each been filled with 7.5 gallons of 80W-90W oil.

1. With the propel selector in SLOW SPEED, check the left crawler function in FORWARD and REVERSE. Record the time for 3 revolutions of the crawler sprocket:

   60 Hz should be 3 revolutions in 63 seconds.

   50 Hz should be 3 revolutions in 75 seconds.

2. Repeat step 1 with the propel selector in NORMAL SPEED. Record the time for 10 revolutions of the crawler sprocket:

   60 Hz should be 10 revolutions in 67 seconds.

   50 Hz should be 10 revolutions in 80 seconds.

3. Repeat step 1 for the right crawler.

4. Repeat step 2 for the right crawler.

Bit Viewing Hatch:

Check the function of bit viewing hatch with the switch in the operator's cab. The hatch should open and close smoothly with no chattering action.

6. With the center guide still over-the-hole from steps 4 and 5, position the switch to STORE and observe that the pressure at test port 77 drops from 600 to nearly 0 PSI.

7. The pressure at test port 78 should be at or near zero while the switch is held in STORE position.

8. When the center guide is at STORE position, return the switch to NEUTRAL and observe that center guide store constant pressure valve turns ON to raise 600 PSI at test port 78.

9. When 600 PSI shows at test port 78, test port 77 should be at or near zero.

10. When 600 PSI shows at test port 77, the pressure at 78 should be at or near zero.

11. Anytime the center guide over-the-hole or store solenoid is energized, the store and over-the-hole constant pressure valves should be turned OFF.

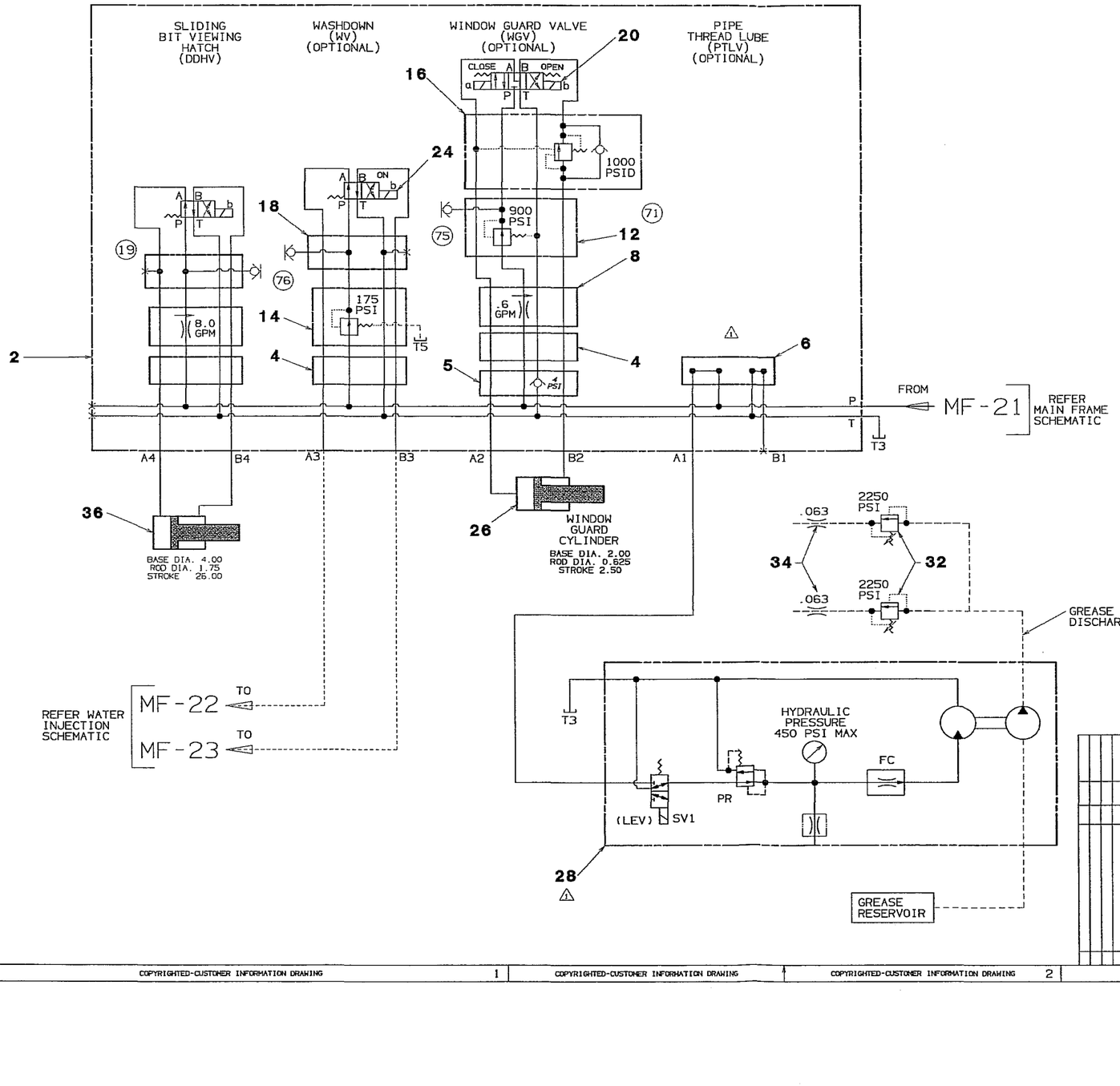
Automatic Breakout Wrench:

1. Attach a 0- 1500 PSI gauge to test port 82 on the reducing/relieving valve to the right of the 8-station valve on the mast.

2. Set the reducing valve to 550 PSI.

3. With the drill steel in the head, lower the head until the steel enters the deck bushing. Engage the tool wrenches to securely grasp the pipe.

Activate the automatic breakout wrench switch to EXTEND and then RETRACT to check proper function.



QUAN	ITEM NO.	DESCRIPTION	PART NO.
1	2	MANIFOLD ASSY. 4 STATION	
2	4	PLATE, MANIFOLD, ADAPTER	
1	5	VLV,SANDWICH,CHECK,4PSI CRACK	
1	6	PLATE, MANIFOLD, CROSSOVER	
1	8	VALVE, SANDWICH, FLOW REG	
	10		
1	12	VALVE, SANDWICH, PRESS RED	
1	14	VALVE, SANDWICH, PRESS RED	
1	16	VALVE, SANDWICH, CBV	
1	18	MANIFOLD, TAP-IN, SANDWICH	
1	20	VALVE, DBL SOLENOID, 50/60 HZ	
	22		
1	24	VALVE, SGL SOLENOID, 50/60 HZ	
1	26	CYLINDER, WINDOW GUARD	
1	28	PUMP, LUBE, HYDRAULIC DRIVE	
1	30	VALVE, CHECK	
2	32	VALVE, RELIEF	
2	34	ORIFICE	
1	36	CYLINDER, BIT VIEW	

NO. D023891

REISSUE DATE 05-03-2005

NO	CHANGE	BY	APP	DATE
1	PER ECN 20052034332	MCB	DB	05/2005
1	UPDATED SCHEMATIC PER NEW PIPE THREAD LUBE PUMP.			

ALL DIMENSIONS IN INCHES-UNLESS OTHERWISE SPECIFIED

MACHINING TOLERANCES-UNLESS OTHERWISE SPECIFIED
1. 2 PLACE DECIMAL DIMENSIONS ± .01 FOR EACH 12 MAX ± .05
2. 3 PLACE DECIMAL DIMENSIONS ± .001 UP TO 3in ± .010 OVER 3in
3. CONCENTRICITY OF CYLINDRICAL SURFACES = .010 T.I.R.
4. PARALLELISM, SQUARENESS, OR ANGULARITY BETWEEN SURFACES AND/OR HOLE CENTERLINES = 0°7' (.002 INCH/INCH)

FABRICATING TOLERANCES-UNLESS OTHERWISE SPECIFIED
1. MATERIAL THICKNESS

DIMENSIONS	± TOLERANCE
A. LESS THAN .12	.010
B. .12 TO .50	.015
C. .50 TO 1.00	.020
D. OVER 1.00	.030

2. BENT ANGLES ±1°(.017 IN/IN) FOR EACH .37 OF MATERIAL THICKNESS (MAX=3°)

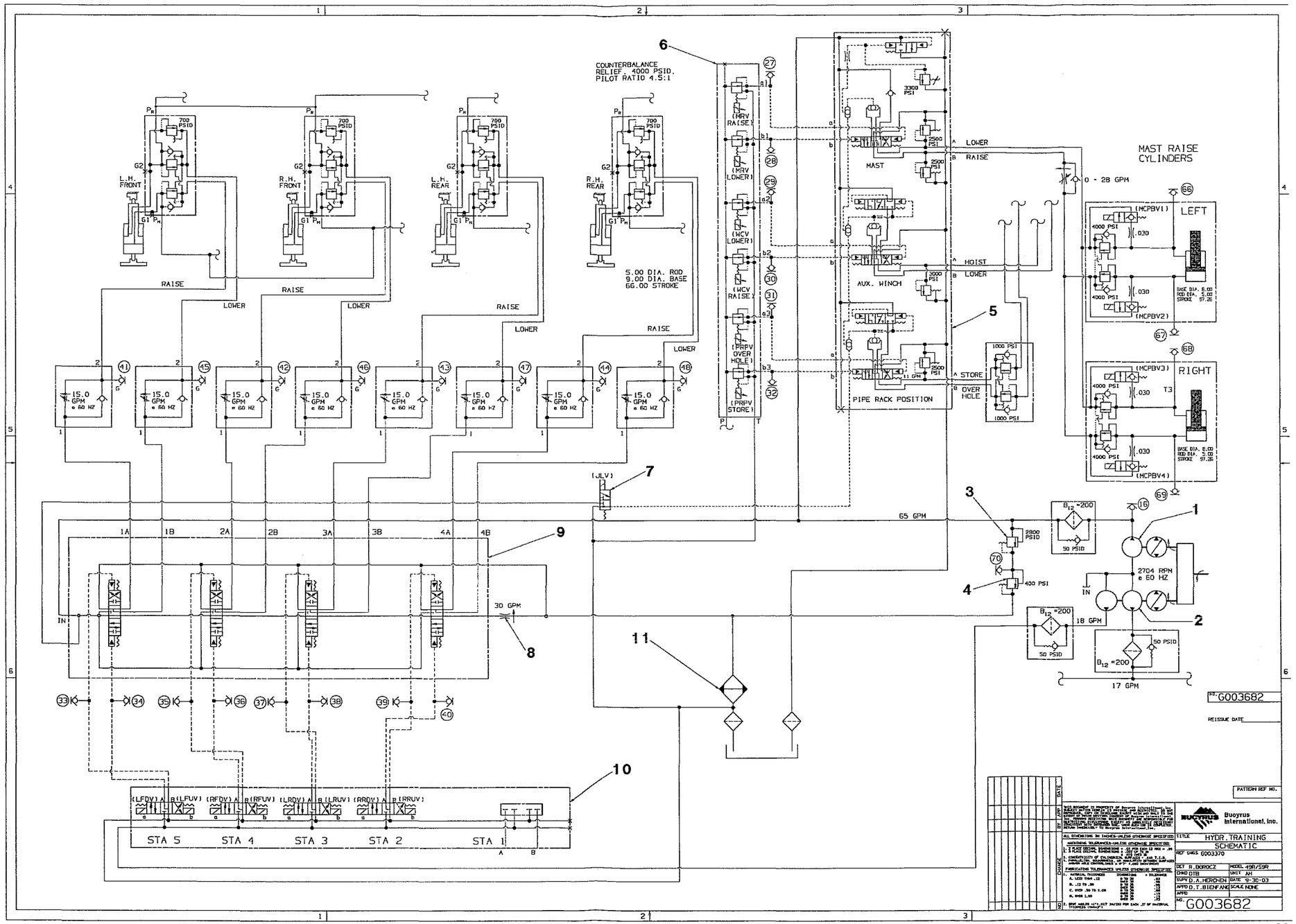
WELDMENT TOLERANCES-UNLESS OTHERWISE SPECIFIED
1.

DIMENSION	MATERIAL THICKNESS	± TOLERANCE
A. UP TO 36"	UP TO 1/4"	.06
	1/4" GREATER TO 1"	.12
B. 36" TO 10'	1/4" GREATER TO 1"	.12
C. 10' TO 30'	1/4" GREATER TO 1"	.18
D. OVER 30'	ALL GREATER	.24

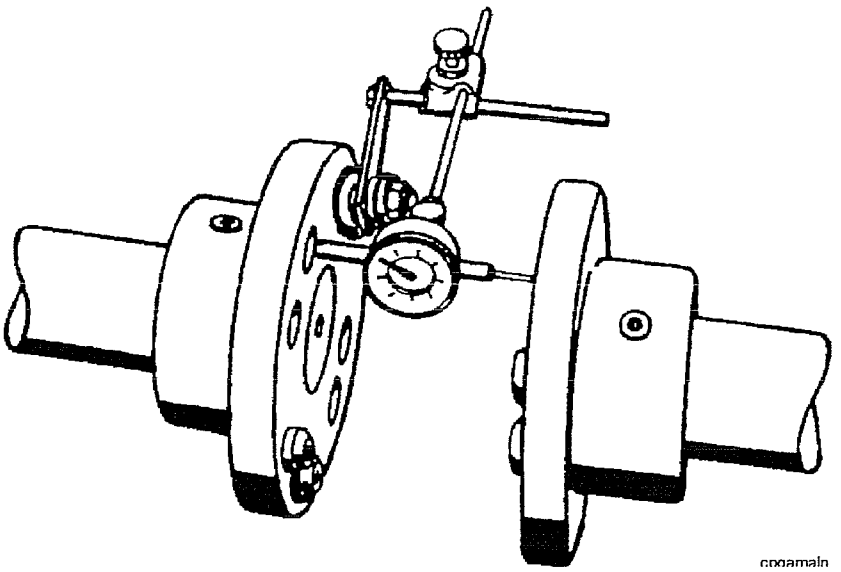
Bucyrus International, Inc.

TITLE	SCHEMATIC 4 STATION MANIFOLD
REF DWGS	D023338
DET LEE MEDROW	MODEL 49R3
CHKD C.FRANCHER	UNIT AH
SUPV L.R.MEDROW	DATE 07/20/98
APPD	SCALE NONE
APPD K.HAMMEL	
NO.	D023891

CADRA


COUNTERBALANCE RELIEF, 4000 PSID. PILOT RATIO 4.5:1
L.H. FRONT
R.H. FRONT
L.H. REAR
R.H. REAR
700 PSID
RAISE
LOWER
5.00 DIA. ROD
9.00 DIA. BASE
66.00 STROKE
15.0 GPM @ 60 HZ
(MRV RAISE)
(MRV LOWER)
(WCV LOWER)
(WCV RAISE)
(PRPV OVER HOLE)
(PRPV STORE)
MAST
AUX. WINCH
PIPE RACK POSITION
3300 PSI
2500 PSI
3000 PSI
1000 PSI
11 GPM
HOIST
STORE
OVER HOLE
MAST RAISE CYLINDERS
0 - 28 GPM
(MCPBV1)
(MCPBV2)
(MCPBV3)
(MCPBV4)
LEFT
RIGHT
4000 PSI
.020
.030
T3
(JLV)
65 GPM
30 GPM
2800 PSID
50 PSID
400 PSI
2704 RPM @ 60 HZ
18 GPM
17 GPM
IN
1A
1B
2A
2B
3A
3B
4A
4B
(LFDV) A B (LFUV) (RFDV) A B (RFUV) (LRDV) A B (LRUV) (RRDV) A B (RRUV)
STA 5
STA 4
STA 3
STA 2
STA 1
1
2
3
4
5
6
7
8
9
10
11

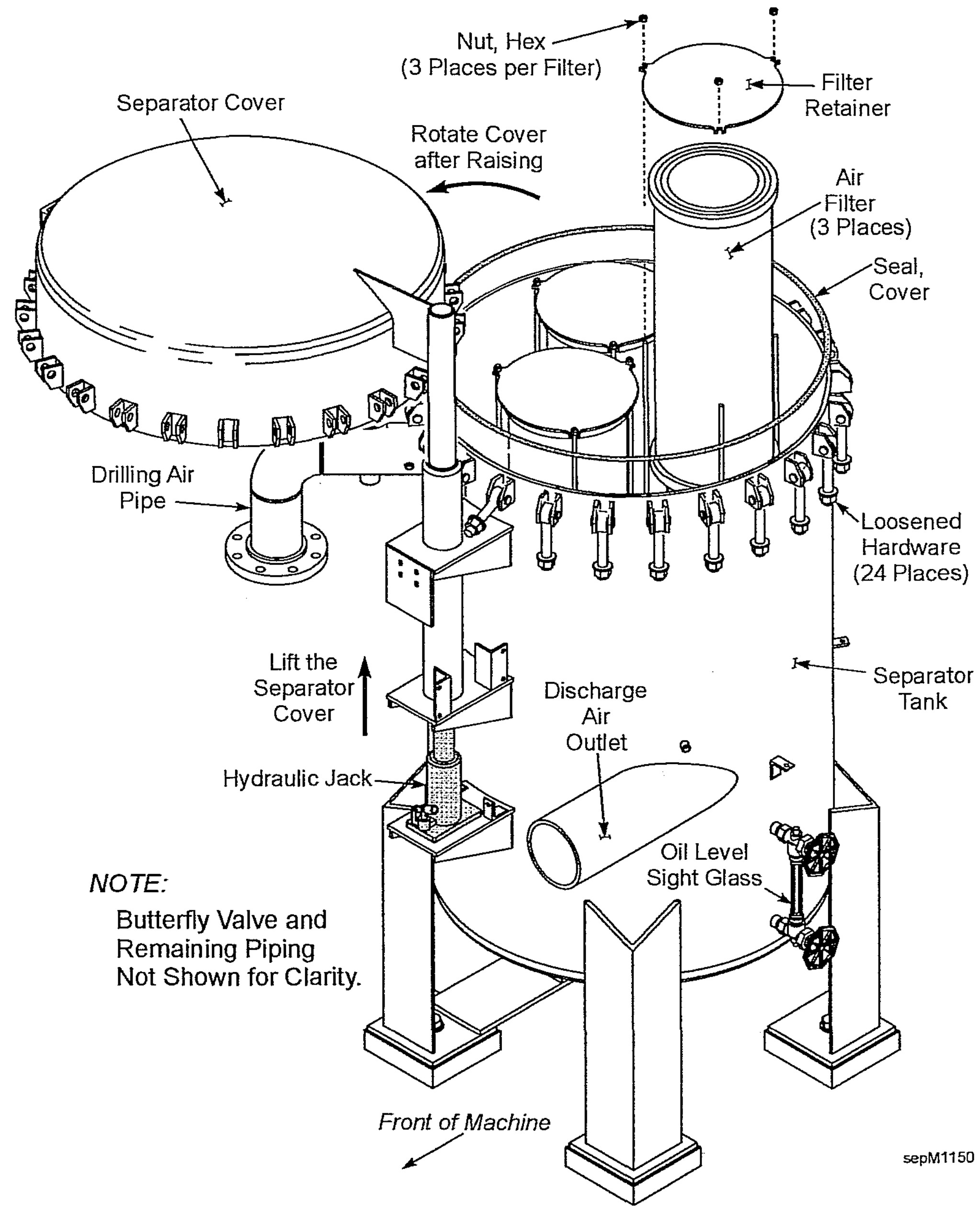
ANGULAR MISALIGNMENT



Checking for Angular Misalignment

1. Mount the indicator between the coupling hubs.
2. Measure the gap between the hubs at 90 and 270 degree positions.
3. Shift the outboard feet until coupling faces are parallel in the horizontal plane.
4. Take coupling readings at 0 and 180 degree positions.
5. Raise or lower the outboard feet with shims to parallel coupling faces in the vertical plane.

SEPARATOR MAINTENANCE



The air compressor separator tank contains 3 air filter cartridges. These must be changed at 4000 hours or anytime more than 10 PSI pressure differential exists across the filters, or if the compressor starts to bypass oil. *To replace the separator filter cartridges:*

1. Shut down the machine. Ensure that the engine and compressor are powered down. Relieve any residual pressure in the main air line and the separator tank.

2. Loosen the 24 hex nuts that attach the separator cover to the tank. Loosen each nut enough to allow the attaching bolt to be pulled away from the tank and lowered.

7. Remove the piston retainer plate bolts and remove retainer plate.

NOTE: A high temperature chemical sealer is used as a gasket between the plate and the piston cylinder.

8. Remove the piston springs. Remove the piston and rod assembly by pulling up on the piston rod. Remove the piston seals from the piston. Discard the seals.

9. Remove the piston cylinder socket head bolts and remove the piston cylinder.

NOTE: A high temperature chemical sealer is used as a gasket between the piston cylinder and air end.

10. Clean all parts thoroughly. Inspect for wear or damage and replace as required. Make certain all old sealing material is removed from the sealing surfaces.

CAUTION: **Take great care not to allow cleaning material, debris, tools or small components to fall into the air intake opening.**

Normally, further disassembly is not required. However, if the operating *piston* or *piston rod* is to be replaced, refer to step 11. If the operating piston rod *bushing* is to be replaced refer to step 12.

11. To replace a piston or piston rod, *proceed as follows:*

    a. Place the piston rod in a soft (wood, copper or brass) jaw vise and clamp securely.

    b. With the correct size wrench, loosen and remove the piston rod bolt.

    c. Replace the damaged parts and reassemble the piston on the piston rod.

    d. Coat the threads of the piston bolt with thread locking compound (Loctite(r) 242 or equivalent).

    e. Reinstall the bolt and tighten securely.

12. To replace the piston rod bushing in the piston retainer, *proceed as follows:*

    a. Place the piston retainer bottom-side-down on a solid, flat surface (bench or press base). Using the correct size shoulder drift (bushing drive), drive or press the bushing downward and out of the retainer.

NOTE: To loosen the locking compound on the bushing, it may be necessary to heat the retainer with a soft flame to 200°F (93°C). This will soften the locking compound.

Section **8**

Heating, Ventilation, and Air Conditioning

Always refer to the safety information in Section 1 of this manual before starting any maintenance procedure on this machine.

Table of Contents

TURN-OF-NUT METHOD

CAUTION: THIS TIGHTENING PROCEDURE IS ONLY APPLICABLE FOR BOLT GRADES 5 AND 8 WITH UNC THREADS. For bolts with other than UNC threads, contact the Bucyrus International Service Department.

NOTE: When using this procedure the bolt threads and the surfaces under the bolt head and nut must be lubricated. This procedure is applicable only if the joint and under head surfaces for bolt and nut are machined for parallelism.

1. The bolts should be brought to a "snug tight" condition to insure that the parts of the joint have good contact with each other. "Snug Tight" is defined as the tightness attained by tightening a bolt to the value specified in the table on the following page. Snug tightening should progress systematically from the most rigid part of the joint to its free edges while alternating from bolt to bolt to assure gradual even pull up of the mating parts. After all bolts have been snugged, the first bolts tightened at the most rigid part of the joint should be rechecked for proper torque retention. If these bolts are loose due to pull up of the joint, the snug tightening sequence should be repeated for all bolts in the connection. This rechecking and re-torquing procedure should be repeated as many times as is required until the joint is completely pulled up and all bolts are at the specified "snug tight" torque. Tightness of the mating surfaces of the joint should then be verified by using feeler gauges.

"Snug Tight" Torque Values			
Bolt Diameter		Torque Values (1)	
Inches	Cm.	Ft. Lbs.	Nm.
.500	1.27	15	20
.625	1.58	30	40
.750	1.90	53	71
.875	2.22	86	116
1.000	2.54	128	173
1.250	3.17	224	303
1.500	3.81	390	523
1.750	4.44	457	619
2.000	5.08	688	932
2.250	5.71	1005	1362
2.500	6.35	1375	1864
2.750	6.98	1864	2527
3.000	7.62	2462	3337

Part No.	Nut Rotation	Bolt Length(2)
747773-01	1/3 Turn of ±10%	Up to and including 4 diameters
747773-02	1/2 Turn of ±10%	Over 4 diameters but not exceeding 8 diameters
747773-03	2/3 Turn ±10%	Over 8 diameters but not exceeding 12 diameters.

(1) Tighten to values listed ± 10%. The torque values listed are calculated for 20% x proof load with lubricated threads and under the head surfaces of the bolt and nut.

(2) In case part number or nut rotation designation is not given, the nut rotation can be determined by the bolt length (Grip length +1/2 bolt diameter.). For bolt lengths exceeding 12 diameters contact the Bucyrus International, Inc. Engineering Department tbl-bt34

Table of Snug Tight Torque Values

2. The nuts and bolts should then be matched marked by center punching the bolt end and nut. On rod bolts match mark both rod ends and nuts. The bolts and nuts should then be tightened additionally by the applicable amount of nut rotation as specified. It is not necessary to follow any particular bolt to bolt sequence during this portion of the "turn of the nut" tightening.

NOTE: Nut rotation is read between punch mark on the bolt and punch mark on the nut. For rod bolts, nut rotation is the cumulative total rotational movement between punch marks on both ends of the rod bolt.