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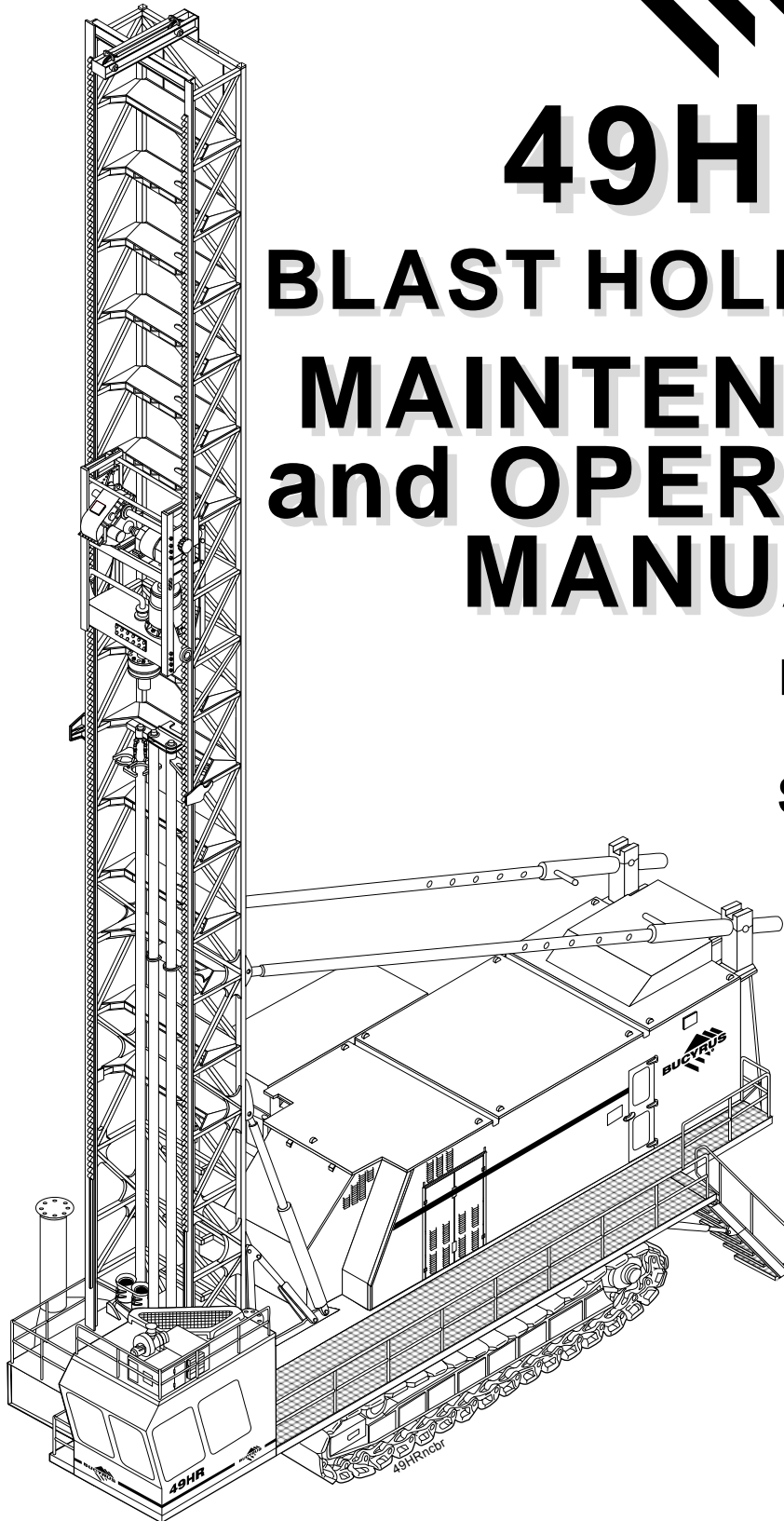
BLAST HOLE DRILL

MAINTENANCE

and OPERATION

MANUAL

Manual No.
11065
SN: 141370



141370mc.cdr Pg. 1

Bucyrus International, Inc.

1100 Milwaukee Ave. • P.O.Box 500 • South Milwaukee, Wisconsin 53172-0500 USA

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SAFETY PRECAUTIONS

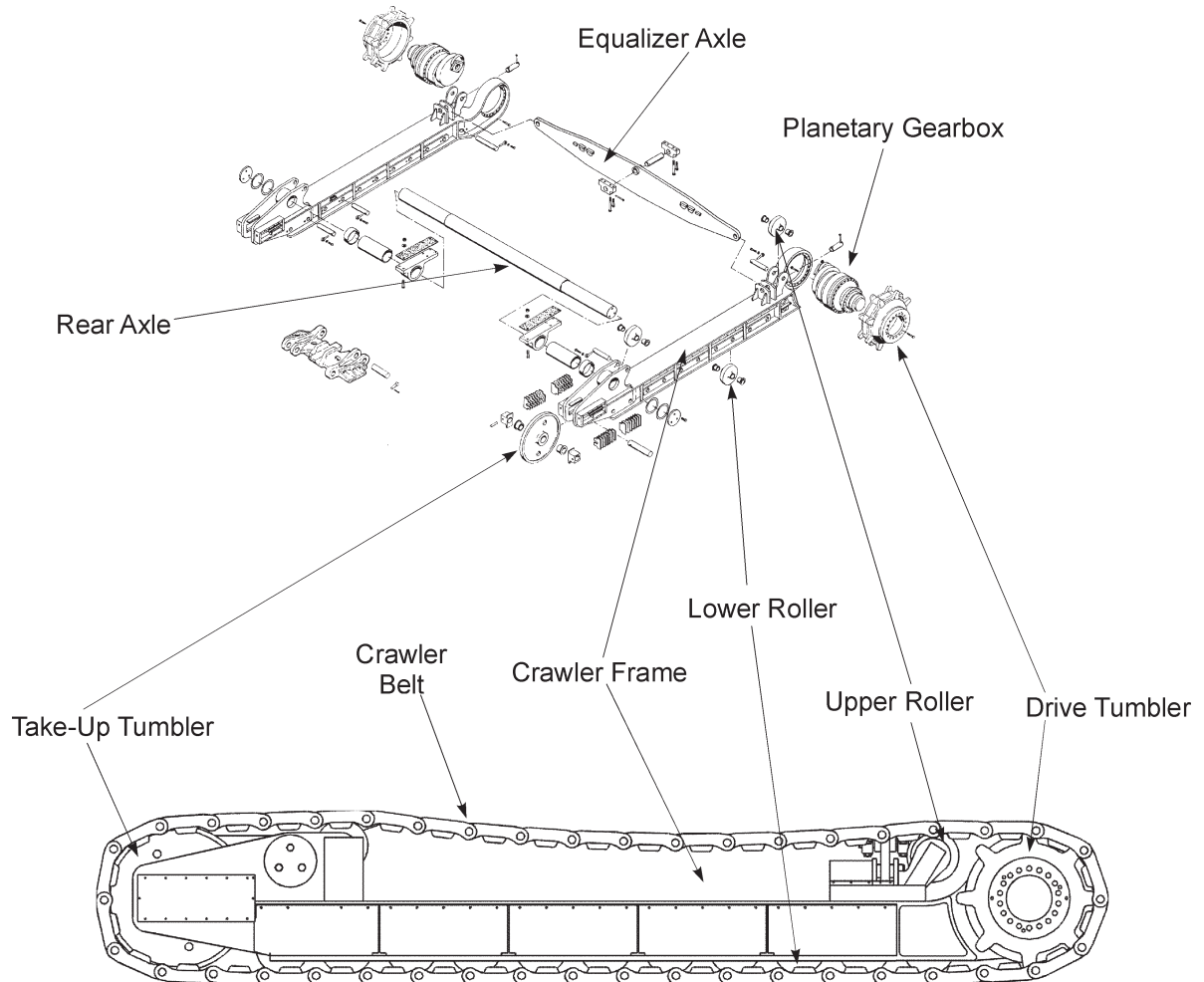
General Precautions:

- 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

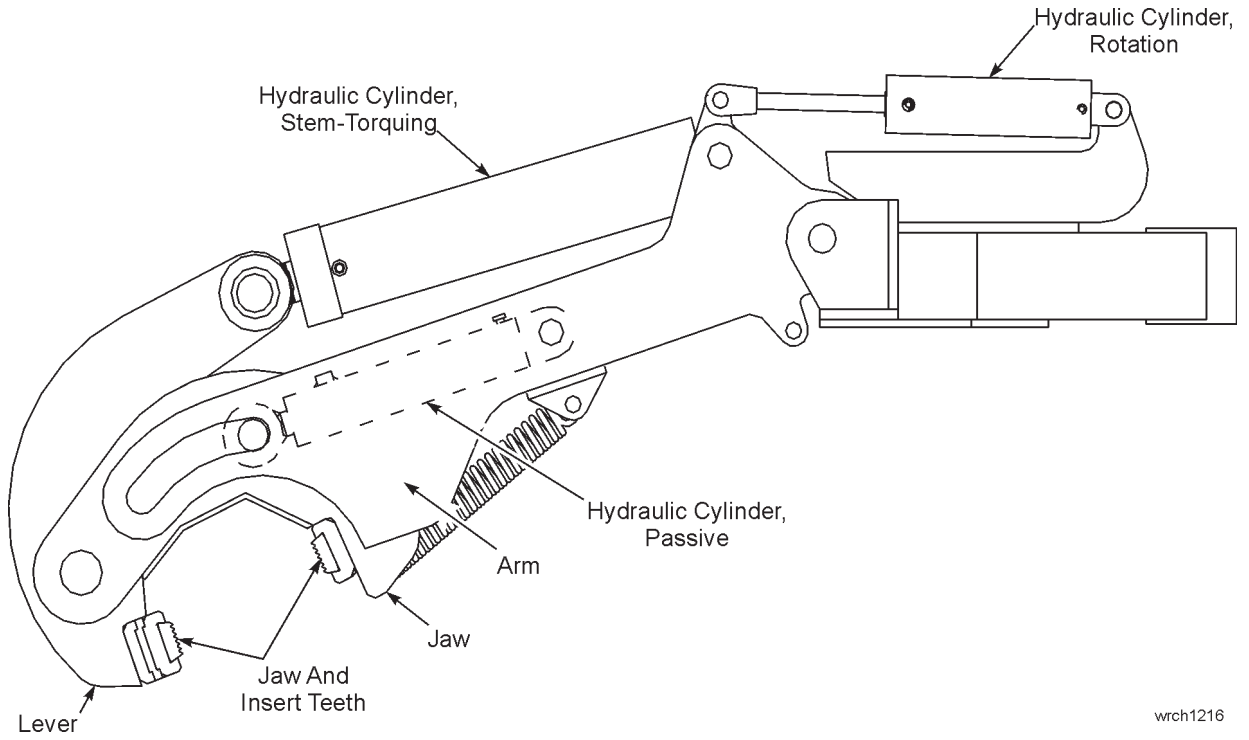
The propel system of this machine is a chainless hydraulic drive system which will allow the separate tracks to counter-rotate. This capability provides the machine with the capacity to turn completely around within its own length. Each track is driven by a hydraulic motor and a planetary gearbox equipped 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 tramping in open areas, over long distances.



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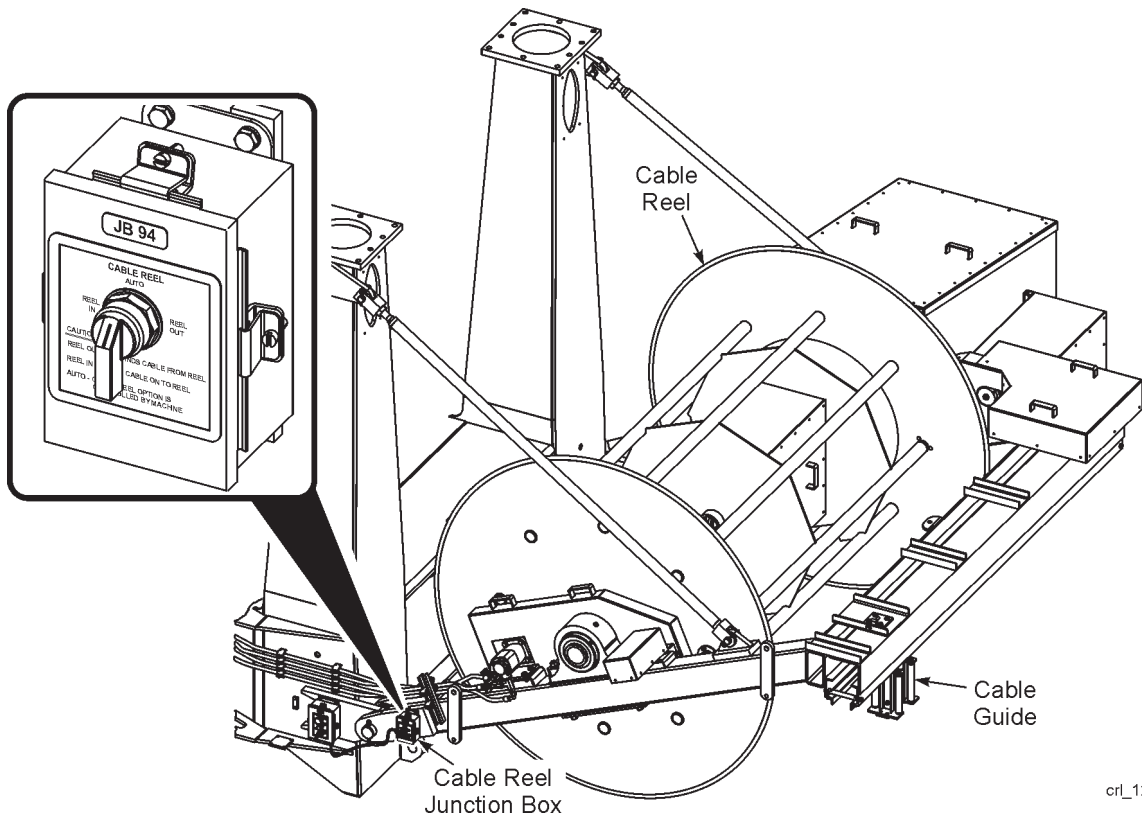


BREAKOUT WRENCH



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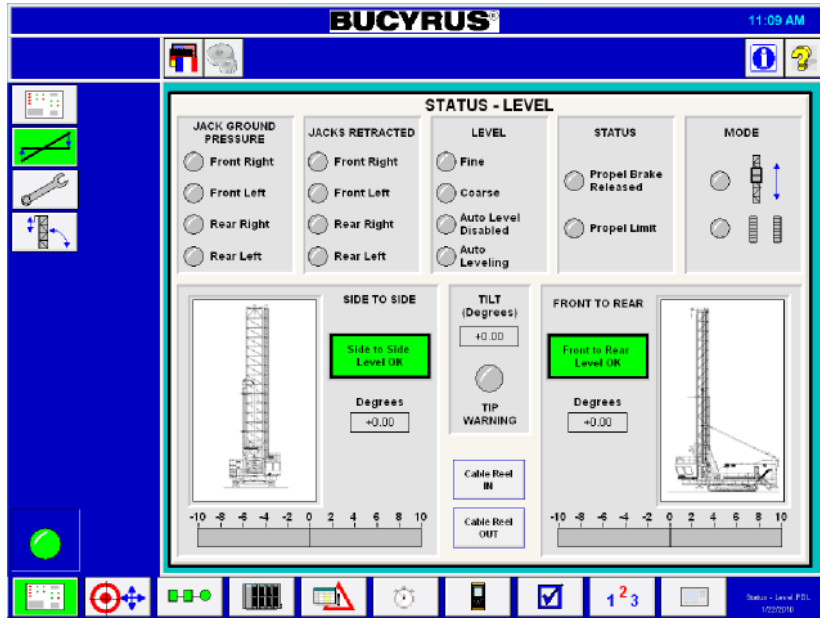
CABLE REEL



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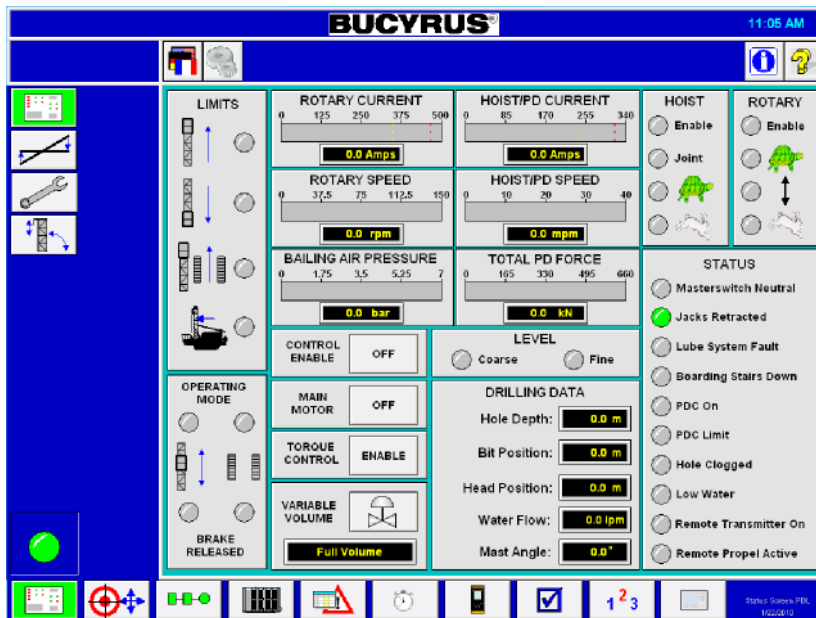
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LEVELING SCREEN

The Leveling Screen provides detail on the machine's level and jack status.



stat1295

STATUS SCREEN

The Status Screen is the primary operational information tool visible to the machine operator during daily use of this machine. The controls available on this screen will provide the operator with the information needed to view “at a glance” the status of items required for drilling, and make changes in control settings. The Status Screen is most commonly used during the drilling process.



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.
6. Inspect the trail cable for proper placement out of the line of travel of the drill. Inspect the insulation for cuts or abrasion. Make sure the cable is kept out of water and away from sharp rocks. Have an electrician inspect the strain relief device and the condition of the cable where it enters the machine.



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.

7. Inspect the underside of the machine for cracks, loose hoses or wires, dirt or ice accumulation, or other deterioration or damage. If loose wires are noted, do not touch them but notify an electrician immediately.
8. Inspect the leveling jack spuds for proper lubricant covering. Inspect the leveling jack pads for cracks, broken or missing pins, or excessive dirt accumulation.
9. Inspect the mast braces and locking pins. Replace missing or defective components immediately. Verify that all adjusting bolts are properly adjusted. Check all hoses and cylinders for leaking.

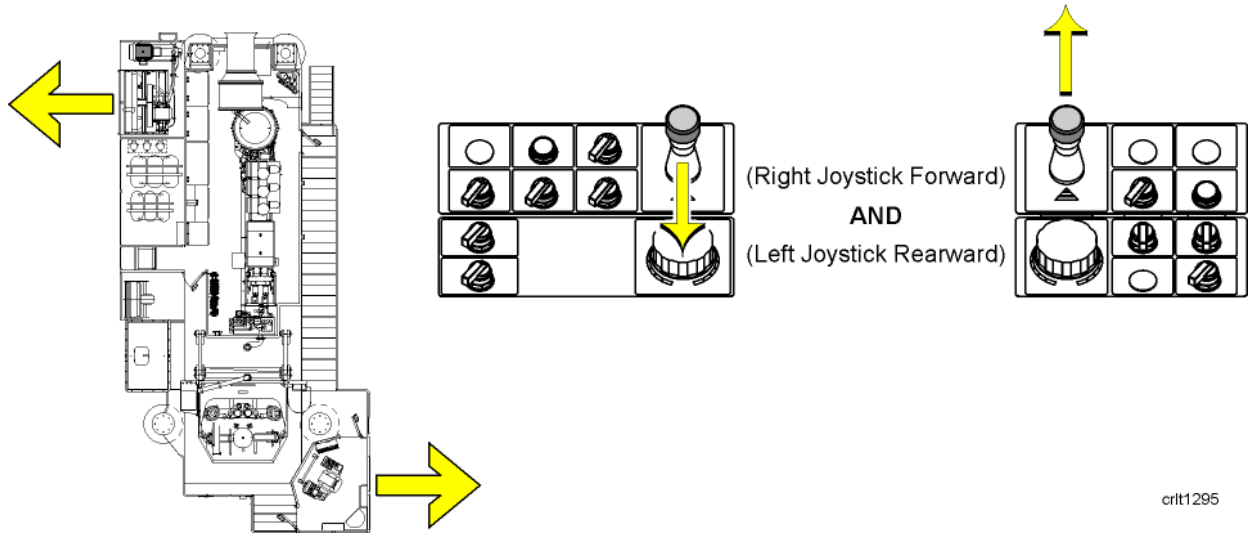


CAUTION: Use a safety belt and lanyard to protect against falls when climbing on the mast braces or working on the machinery house roof.

10. Inspect the mast hinge pins for loose or missing keepers or bolts. Replace missing or damaged parts immediately. Check the pins for sufficient lubrication and lubricate if necessary.
11. Inspect the mast hoist cylinders for loose or missing pins or keepers, oil leaks, damaged hoses or structural damage. Repair or replace any missing or damaged components immediately.
12. Inspect the mast structure for bent or broken chords or plates, loose or broken parts, proper rack lubrication or excessive rack wear. Inspect ladders, handrails and platforms for broken or missing parts. Repair or replace broken or missing parts immediately.
13. Check the main air flex hose, lubrication lines, and electric lines running from the mast to the rotary drive/pulldown unit for interference with the mast or excessive wear or leaks.



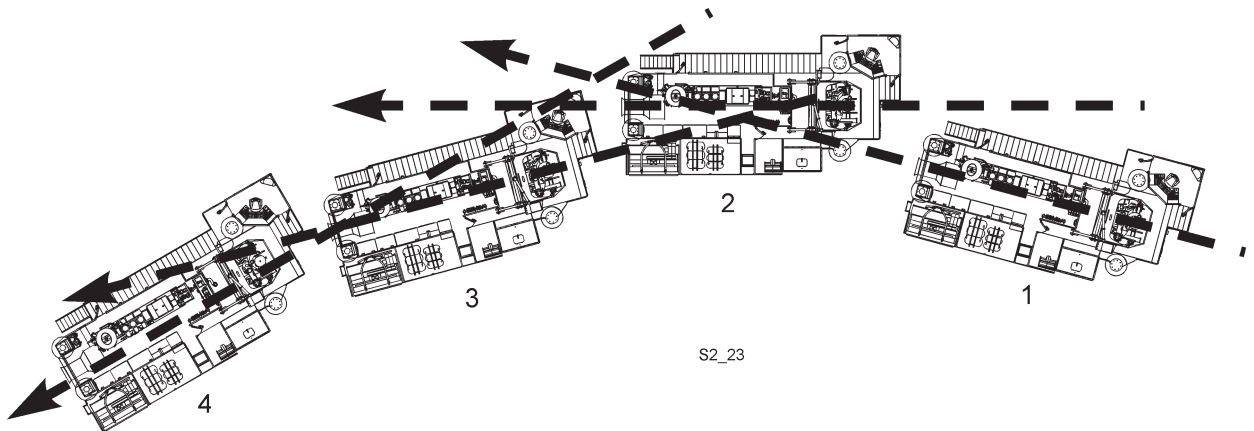
- Gradual turns should be done in steps of 15 degrees each. After turning the machine a maximum of 15 degrees, the machine should be propelled straight for about one-half of the length of the machine to clear the crawler belts of dirt and rocks. Turning the drill in more than 15 degree increments will subject the crawler belts to severe strain.



crit1295

COUNTER-ROTATION LEFT HAND TURN

- To make a sharp counter-rotation turn, push the left joystick forward and pull the right joystick to the rear. To make a turn to the left, push the right joystick forward and pull the left joystick to the rear.



S2_23

ENSURE GRADUAL TURNS ARE MADE - 15° INCREMENTS



CAUTION: ENSURE THAT THE TURN IS STOPPED EVERY 15 DEGREES AND THAT THE MACHINE IS PROPELLED FORWARD, OR REARWARD, AT LEAST TEN FEET PRIOR TO RESUMING THE TURN. MAKING GRADUAL TURNS WILL GREATLY EXTEND THE SERVICE LIFE OF THE TRACKS.



NOTE: Pay close attention to the hoses, wires and cables that run between the mast support and the mast to prevent damage to the machine as the mast is being lowered. Have the helper observe the machine from a safe position on the left side of the machine as the mast is coming down.

NOTE: Do not allow the mast, especially if near horizontal to lower too quickly. Damage may result from the mast hitting the mast rests too hard.

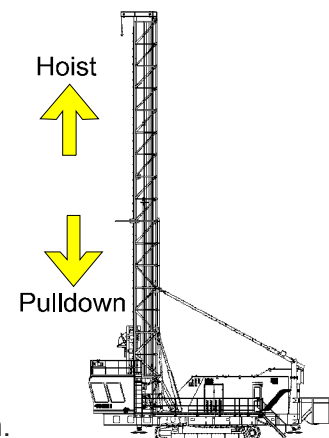
8. Once the mast is resting in the mast rests, inspect the mast and the mast support to verify that no hoses, wires or cables are kinked or damaged. Repair any damages found immediately.

PULLDOWN MACHINERY OPERATION

Use of the pulldown machinery is necessary during the tool handling and the drilling procedures. The pulldown machinery supplies power to either raise or lower the rotary/pulldown unit. Power is supplied to the pulldown gearbox by an electric motor.

To operate the hoist/pulldown machinery proceed as follows;

1. Move the operating mode selector switch to the DRILL position.
2. Turn the hoist/pulldown selector switch to either PULLDOWN, HOIST HIGH, HOIST LOW, or PIPE RACK/JOINT.



For this procedure, turn the switch to the PULLDOWN position.

S2_33

For a review of each switch position, refer to HOIST/PULLDOWN SPEED SELECTOR SWITCH.

3. Press the drill/propel control ON push-button. The Control Enable indicator will show on the operator's display screen.
4. Turn the hoist brake switch to the RELEASE position. The Head Brake Released indicator will appear on operator's display screen.
5. Rotate the hoist/pulldown rheostat in the hoist direction to hoist the rotary/pulldown unit. The farther the rheostat is turned to the right the faster the unit will be raised.



There is no provision made for holding the pipe stationary in the rack while the joint is tightened. If the joint does not tighten using the above procedure it may be necessary to apply a small amount of hoist power to the rotary/pulldown unit to lift it slightly to remove the pressure from the drill threads.



CAUTION: Do not lift the drill pipe. Lift the rotary/pulldown unit only enough to relieve the pressure on the threads. Lifting the unit enough to lift the pipe will not only put pressure on the other side of the threads, but may also allow the pipe rack upper gate to open. Should the joint uncouple at this point, the drill pipe may fall out of the rack, causing death, serious injury or serious machine damage.

If the pipe joint does not make up by relieving the weight of the drive unit from the threads it will be necessary to inspect and/or repair the threads on the rotary coupling and the drill pipe. Inspect the threads for rough surfaces and burrs and apply a liberal coat of thread compound to them. The threads should have a smooth finish and no burrs or dirt that will hinder joint make-up. The joint shoulders should also be clean and smooth and should have compound applied.

After cleaning and repairing the threads, try making the joint again. If the joint cannot be made, either the drill pipe or the coupling is defective. Replace the pipe or coupling as necessary.

8. Once the joint is made up between the coupling and the pipe, the pipe is now ready to be lifted out of the pipe rack pocket. Lift the pipe approximately a foot above the top of the pocket to allow the pipe rack to swing out of the way. Set the hoist brake.
9. Once the pipe has been lifted clear of the pipe rack, swing the pipe rack to the STORED position by lifting and pushing the joystick rearward to the STORED position.

NOTE: Verify that the upper gate on the pipe rack is open before retracting the pipe rack. Retracting the pipe rack with the gate closed will cause damage to the pipe rack.

10. Once the pipe rack has been stored the pipe should be cleaned out using the bailing air. Remove all personnel from the area and turn on the bailing air for a moment. After cleaning the pipe, clean and lubricate the threads and shoulder on the lower end of the pipe and the upper end of the stabilizer.



CAUTION: Before working around the tool string set the hoist brake. Press the control ENABLE button.

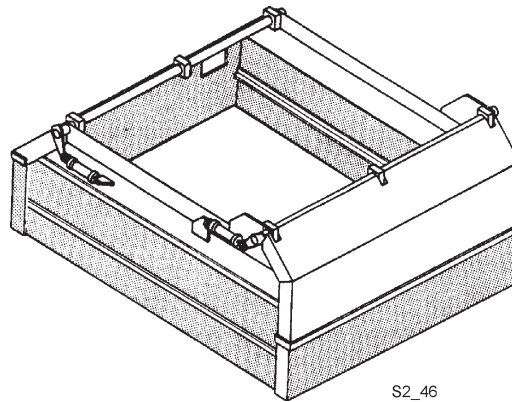
11. Release the hoist brake and lower the rotary/pulldown unit until the drill pipe is approximately 1 foot above the upper end of the stabilizer. Reset the hoist brake.
12. Turn the rotary rheostat clockwise until the drill pipe begins to turn at approximately 5 RPM as shown on operator's display terminal operator's display screen. Release the hoist brake and carefully lower the rotary drive unit until the drill pipe contacts the stabilizer. Allow the rotary drive unit to continue to lower under gravity while the drill pipe is threading onto the stabilizer.



DUST SUPPRESSION SYSTEM OPERATION

Most drills are equipped with some sort of dust control system. This system may be either a dry type filter or a water injection system. Dust control is necessary to contain the dust generated by drilling from escaping to the environment. All machines are equipped with dust control curtains and dust seal to contain the dust around the drill hole as standard equipment. The dust seal must be adjusted to the pipe angle when angle hole drilling.

There are two ways to suppress dust generation or prevent the escape of the dust to the atmosphere. The two methods cannot be used at the same time as they are not compatible. One method to suppress the generation of dust is to inject water into the main air stream as it passes to the bit.



S2_46

The water serves to conglomerate the dust particles into larger particles that may be treated as cuttings. The other method to suppress the dust is to contain the dust in the dust curtain enclosure then draw off the lighter particles and filter them out of the air before returning the air to the atmosphere. The filtering is done by a filter unit, which forces the dust laden air through filters where the dust is removed. In the filter system, the dust must remain dry as wet material will plug the filters.

NOTE: When the machine is equipped with a dry-type dust filter system, the air for cleaning the filters is drawn from the bailing air system. Air pressure to the dry-type dust filter must be maintained at 40 PSI (276 kPa) to ensure proper cleaning of the filter elements.



If the plug does not clear itself after repeated attempts at clearing it, there are two options available. The tool string can be abandoned immediately without further trial or an attempt to drill through the plug using the top of the bit can be made. In either case the hole being drilled will have to be abandoned. In the first case the cost of the abandoned tool string is known, while in the second case a gamble is being taken as the bit and stabilizer will almost certainly have to be scrapped and there is no guarantee that the rest of the drill pipe will be recovered. If it is decided to abandon the tool string, attempt to unscrew a section of pipe to recover some of the tool string. If this cannot be done, lower the tool string to the bottom of the hole and then, using a suitable burning torch, cut the drill pipe at ground level. It will be necessary to move over an existing hole to remove the stub of pipe from the rotary drive unit.



CAUTION: Before cutting the drill pipe verify that the main air compressor is shut down. Burning the pipe with the main air compressor running may cause a fire or explosion as hot slag is introduced to the main air stream or may cause hot material to be blown back onto the torch operator.

If an attempt is to be made to free the drill string by drilling with the top of the bit, apply only enough hoist pressure to keep the vibration and rotary motor load levels in an acceptable range. Vary the hoist pressure by alternately placing the hoist/pulldown selector in the hoist and neutral positions. Vary the rotary speed to help reduce vibration. Drilling through a large block with the top of the bit can be a lengthy procedure and it is important to prevent damage to the rest of the machine. Once the tool string is free, check the bit and stabilizer as well as the drill pipe for damage. Replace components and move to a new location for the hole. Do not try and drill the same hole again as this will almost certainly cause the tool string to become stuck again.

WET OR STICKY FORMATIONS

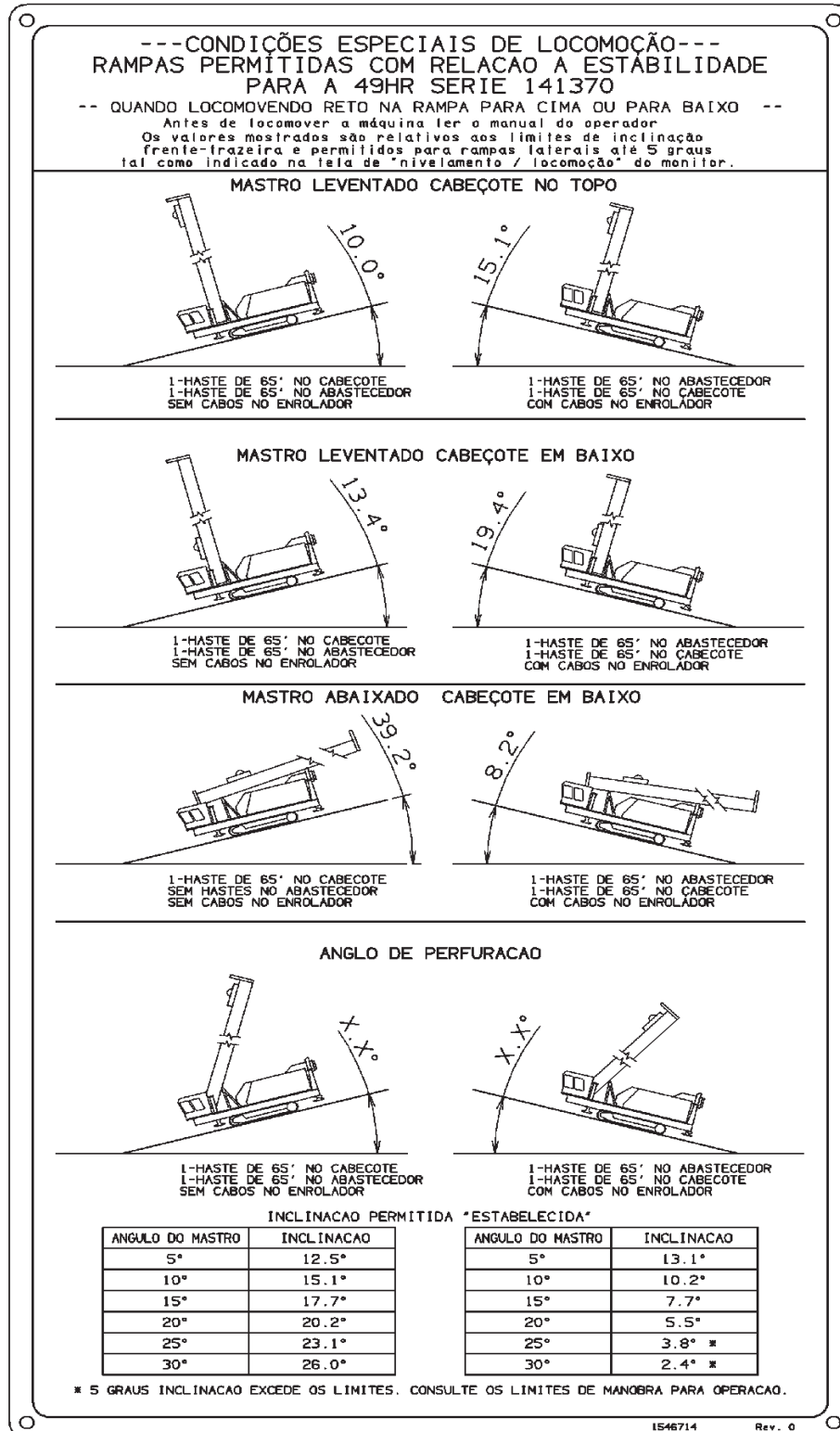
Drilling in wet or sticky formations presents three possible problem areas. The three problems that may be encountered are coating of the hole and pipe with material, conglomeration of the material into pieces too large to remove with the bailing air stream and caving of the hole. Either of these problems may be present, or any combination of the three may be present at the same time.

Drilling in wet formations follows the same practices as drilling any other formation. Drilling wet formations, however, requires that particular attention be paid to the bailing air pressure and penetration rates. Wet formations are more susceptible to plugging the hole, but recovering the tool string from the plugged hole is easier than with unconsolidated material.

In the case where the material is adhering to the drill pipe and coating the sides of the hole it is necessary to ream and clean the hole every 5 to 10 feet (1.5 to 3.0 m) to remove the offending material. It is also necessary to clean the drill periodically to remove the caked on material. This can be accomplished by removing the tool string from the hole and allowing the material to be scraped off by the guide bushing. It is important then, if the guide bushing is to be used to clean the tool string, that the bushing be kept in good repair.

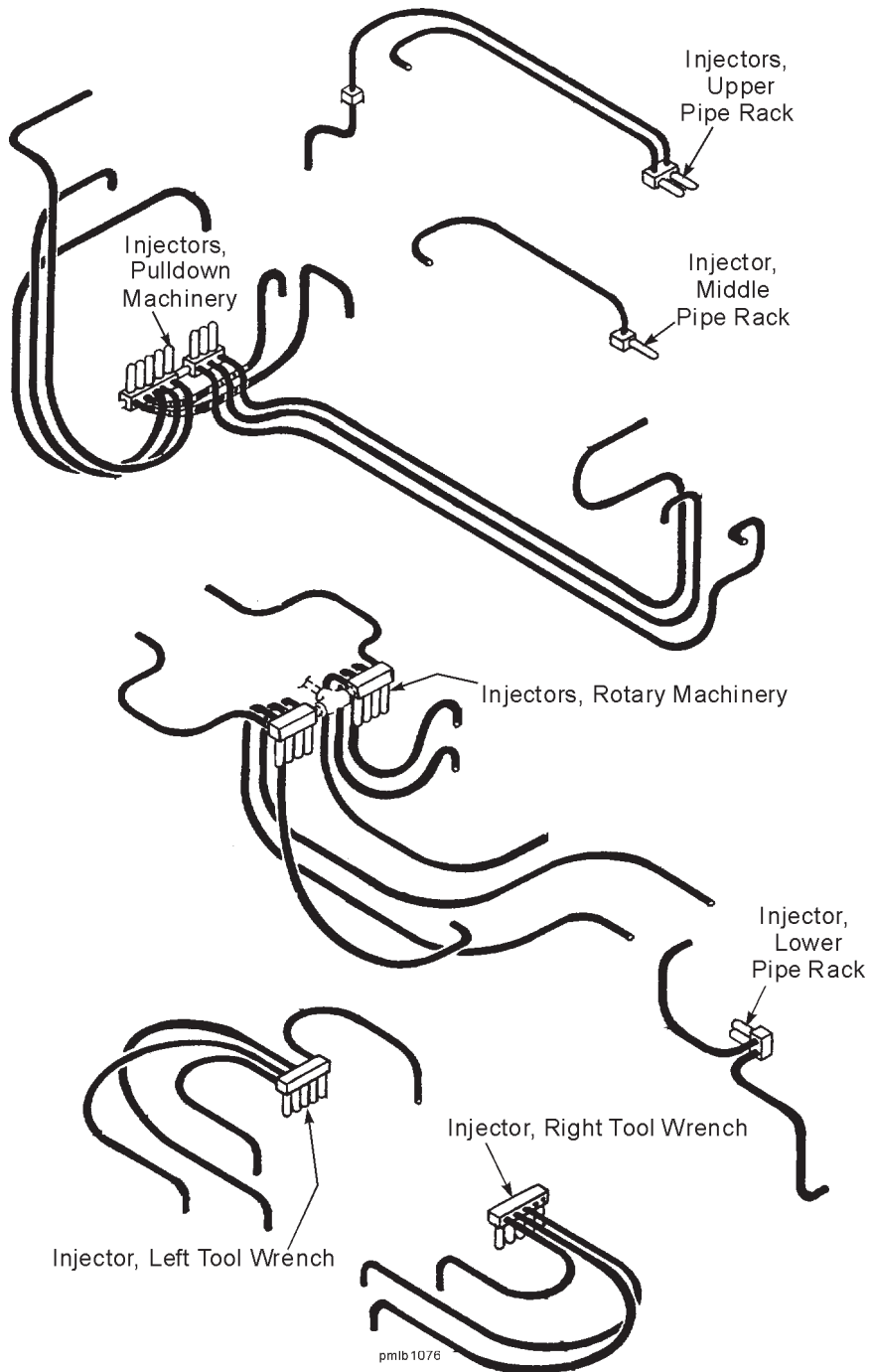


DRILL STABILITY CHARTS



dsta 1370

Drill Stability Chart - Special Propel Conditions



Auto Lube Piping ~Mast (View #2)



PUMP ASSEMBLY PROCEDURE

1. When the pump is disassembled, it is recommended to replace all seals and gaskets. For replacement parts and service kits, refer to part sheet, "PUMP, HYDRAULIC, ROTARY DRIVEN" in the parts manual for this machine.
2. In the process of disassembly, examine the following components and replace if excessive wear is indicated:
 - Ball Bearing (8)
 - Crank Eccentric (7)
 - Crank Rod (5)
 - Wrist Pin (13)
 - Plunger Tube (11)
 - Pump Plunger, Ball & Spring (18-20)
 - Pump Cylinder (24)
 - Check Seat Housing & Ball (26 & 28)
 - Upper Bronze Bushing (51)
 - Housing Tube (55)
 - Shovel Plug (56)
 - Reciprocating Tube (21)
3. The assembly procedure is reverse of the disassembly procedure except for the following:
4. Install parts (22-28) into reciprocating tube (21) after the plunger assembly (9-20) is installed.
5. Install the pump sub-assembly (1-28) into the pump housing (46) before tightening the housing tube (55) to the pump housing (46). Be sure the reciprocating tube (21) is inserted through both bushings before tightening the housing tube (55).
6. Use Loctite 242 (or similar product) medium strength thread lock on all torqued threaded connections. Extreme care must be exercised to prevent excess compound from flowing into critical areas such as clearance fits and ball check. Allow a minimum of 30 minutes cure time before operating the pump.
7. Torque Specifications:
 - A. Plunger Tube (11) to Outlet Pin (9) ~ Tighten to 100-110 In.Lbs.
 - B. Button Head Screws (12) to Wrist Pin Anchor (14) ~ Tighten to 100-110 In.Lbs.
 - C. Plunger Tube (11) to Plunger Link Rod (17) ~ Tighten to 100-110 In.Lbs.
 - D. Plunger Link Rod (17) to Pump Plunger (20) ~ Tighten to 100-110 In.Lbs.

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**SPECIFICATION FOR
MPG – MULTI-PURPOSE GREASE
SD4711** *(August 18, 2005)*

SCOPE:

1. This specification covers “Multi-Purpose Grease”.
2. Materials furnished under this specification are primarily intended to lubricate heavy duty ball, roller, and plain bearings.
3. The material furnished under this specification must be dispensable through the distribution lines of a centralized lubrication system to the most remote application point, at the lowest anticipated operating temperature. It must not plate or plug components of the centralized lubrication system such as injectors or metering blocks.
4. The particular grade or consistency selected must perform within the specific temperature range in which it is utilized.

PHYSICAL CHARACTERISTICS:

1. Heat Resistance - Shall be thermally stable, should not flow or harden in service.
2. Retention - Shall not exhibit high leakage.
3. Stability - Shall work continuously with a minimum change in consistency.
4. Water Resistance - Shall withstand water washout or leaching.
5. Reversibility - Shall be stable with repeated heating and cooling.
6. Pressure Separation - Shall resist oil-soap separation.
7. Extreme Pressure - Shall withstand heavy shock loading.
8. Compatibility –
 - a. Low temperature greases shall be compatible with mineral oil base greases.
 - b. Grease must be compatible with oil seal lip materials (Nitriles, Viton), and all centralized lubrication system components (i.e. gaskets, o-rings, vent valves, etc.). Reference ASTM D 4289-03.
9. Compounding –
 - a. Suitable for producing the extreme pressure characteristics (without inert fillers) required for heavy duty ball, roller, and plain bearing lubrication.



**SPECIFICATION FOR
OGL – OPEN GEAR LUBRICANT
SD4713** *(August 18, 2005)*

5. Viscosity, a fluid's resistance to flow, is the principal physical characteristic of a fluid in terms of its ability to produce a lubricating film between two interfacing surfaces. All lubricating fluids possess a natural viscosity that may be altered (enhanced) by additives such as resins or polymers. Some "viscosity enhancers" are shear sensitive, which could result in insufficient protection of the lubricated components under high load, elevated temperatures and/or high shear conditions. The viscosity of the fluids utilized in the open gear lubricants shall be sufficient under operating conditions for the product to meet or exceed the performance requirements listed in the "MINIMUM PERFORMANCE REQUIREMENTS" section.
6. Open gear lubricants supplied under this specification must be specifically formulated to protect surfaces, reduce wear, and provide satisfactory service life under all anticipated operating conditions.
7. Open gear lubricants supplied under this specification must have excellent water tolerance and rust preventive qualities, as well as minimal dripping qualities for operation over wide temperature ranges.
8. Should the material furnished under this specification contain a diluent to improve dispensability, special care must be exercised to ensure its compatibility with all centralized lubrication system components, i.e., gaskets, o-rings, vent valves, etc., and oil seal lip materials (Nitriles, Viton). Reference ASTM D 4289-03.
9. For extended use in low temperature areas, open gear lubricants supplied under this specification should be capable of slumping in containers and should be pumpable through lube lines without the aid of heat tracing. In order to minimize compatibility problems, it is desirable that the thickener and additive system be compatible with the additional grades that are suitable for the other ambient temperatures.

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PREVENTIVE MAINTENANCE FOR LUBRICATION

Lubrication may well be the most important portion of a preventative maintenance program. Do not allow anything to interfere with the lubrication of the machine. Experience will dictate how to adjust the amount of lubricant to use at each servicing. However; the extra effort will result in a smooth running machine with less wear and breakdowns.

It is difficult to predict how much lubricant should be applied to a particular bearing. It varies with how hard the machine is being worked, how much the bearing has previously worn and the grade of lubricant being used. Watch all the bearings closely to insure that the lubricant added at one servicing is enough to last until the next.

Most wearing parts require that lubricant be applied regularly in small quantities as with the automatic lubrication system instead of large amounts applied occasionally. Make regular inspections of the machine and watch for signs of improper lubrication such as the accumulation of excess lubricant or discolored lubricant. Ensure that the lubricant has not come from a broken or disconnected line or lubricant pipe. Normally excess lubricant pumped into a plain bearing is not used. However, certain bearings in locations which may collect dirt should have extra lubricant added to purge all of the old lubricant which may have collected abrasive dirt.

New bushings sometimes overheat because they are too tight to allow normal distribution of lubricant. Old bushings may overheat because they are so worn that lubricant will not stay in until the next time of servicing. In the case of the new bushing, it may be necessary to give it more frequent lubrication until it is worked in. It may be necessary to do the same for the old bushing, until it can be replaced. It is much better to lose a little time on a shift to give some extra lubricant to a point which needs it rather than trying to run it to the end of the shift.

The most common cause of overheating an anti-friction bearing is churning of the lubricant. This happens when the bearing is packed excessively full. If lubricant leaks out of an anti-friction bearing, it is almost a sure sign that too much lubricant was added to the bearing. Continue to lubricate it as often as before, but use less lubricant.

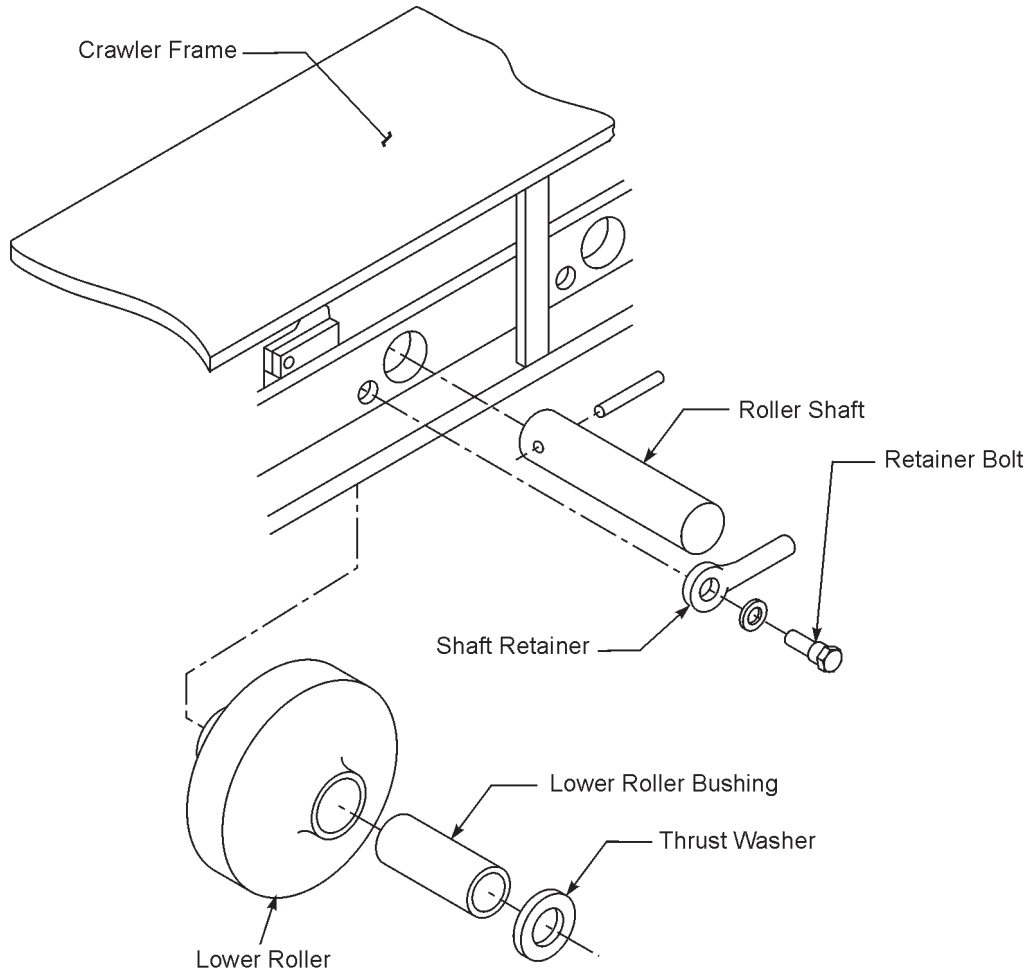
Section 3 of this manual will provide more detailed and specific information on lubricants and their usage.



10. Insert the link pins and cotter pins to complete the belt.
11. Readjust the belt tension as described in the topic Crawler Belt Adjustment.

LOWER ROLLERS

Inspect the lower rollers for cracks and damage that can impair normal tracking of the crawler belts.



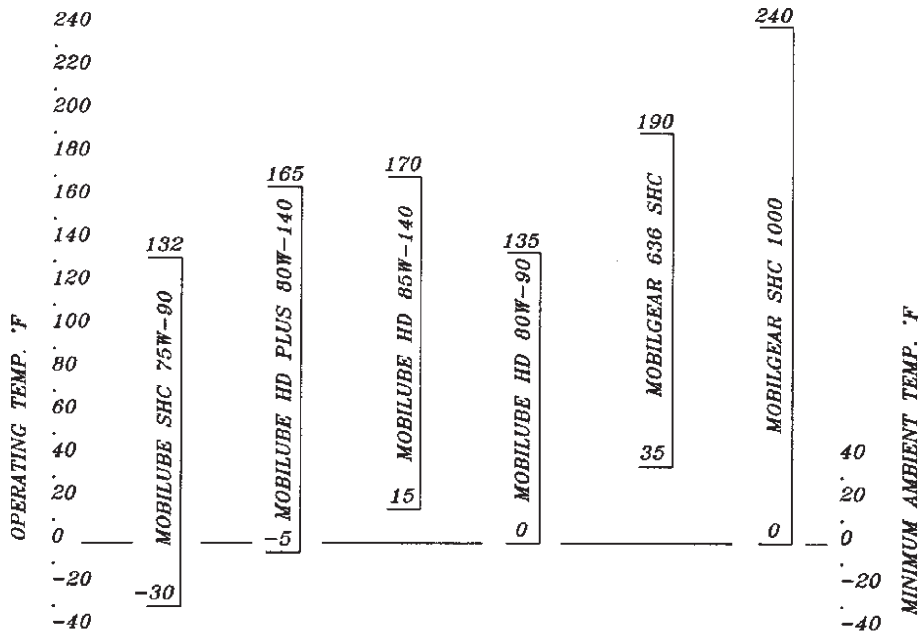
S5_06

Lower Roller - Details

Once a month raise the machine with the leveling jacks to allow inspection of the rollers. Block the machine in a raised position. Using a suitable lever, check the clearance of the thrust washer by lifting and then lowering the roller. Replace the thrust washers if clearance is excessive.



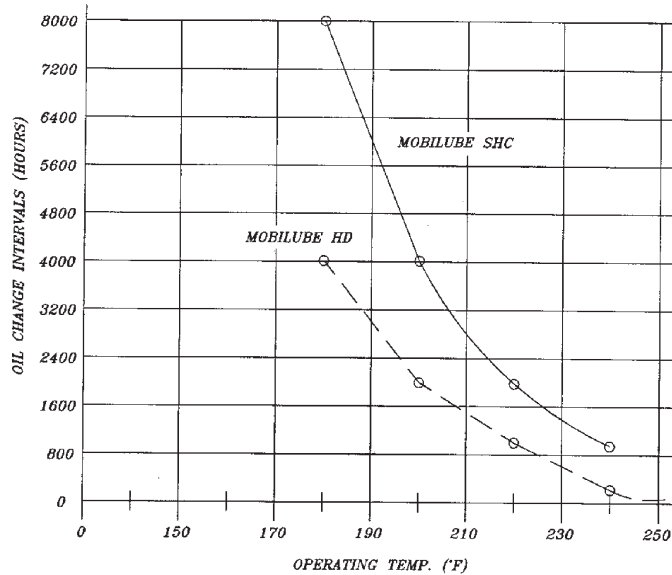
LUBRICANT SPECIFICATIONS



S5_11

Planetary Gearbox Lubrication Specifications

1. The oils shown in figure above contain phosphorous type extreme pressure additives. Other oils of equivalent quality and properties may be used, provided they contain phosphorous type extreme pressure additives.



S5_12

Oil Change Intervals

2. Contamination depends on operating conditions and operating temperatures. Operating at temperatures of 180° F or above for continuous service will require more frequent oil changes.



REPAIR

Repair of the leveling jacks is limited to repair welding of selected components and clean-out of others. Repair welding of structural damage is allowable on the jack casing and jack pad. Follow the recommended repair welding practices detailed in the Appendix to repair these items. Repair welding of the jack spud is not recommended if the damage has caused the spud to be bent or become out-of-round. The spud should be replaced if it is bent or no longer round.

Repair of the hydraulic cylinder is limited in this manual to clean-out of the cylinder. Repair of the cylinder itself follows the basic procedures for repair of any hydraulic cylinder.

Repair of the jack casing is limited in this manual to repair of minor cracks or damages. Should any serious damage occur, consult the Bucyrus International Service Department for repair details. Note that bolts securing the rear jack casing to the mainframe are torqued to 390 ft. lbs. (snug-tight) then turned an additional 1/2 turn. Refer to turn-of-the-nut torquing method later within this section. There should be hardened washers under bolt heads and nuts.

To remove and replace a hydraulic cylinder and jack spud proceed as follows:

1. If the rear jack is to be worked on, lower that jack until the pad is 1 or 2 inches from the ground. Raise the other three jacks not being worked on, to the full retracted position. If a front jack is to be worked on, both front jacks should be lowered to 1 or 2 inches from the ground. Raise the rear jacks to the full retracted position.
2. Stop the hydraulic pump and relieve any pressure in the system by loosening the reservoir breather. When trapped air in the reservoir is relieved, immediately replace the breather.
3. Carefully disconnect the main hydraulic lines attached to the counterbalance valve at the jack cylinder.

NOTE: Do not disturb the lines going from the counterbalance valve to the electric junction box.

4. With appropriate plugs, seal open holes in the main hoses that were removed in step 3.



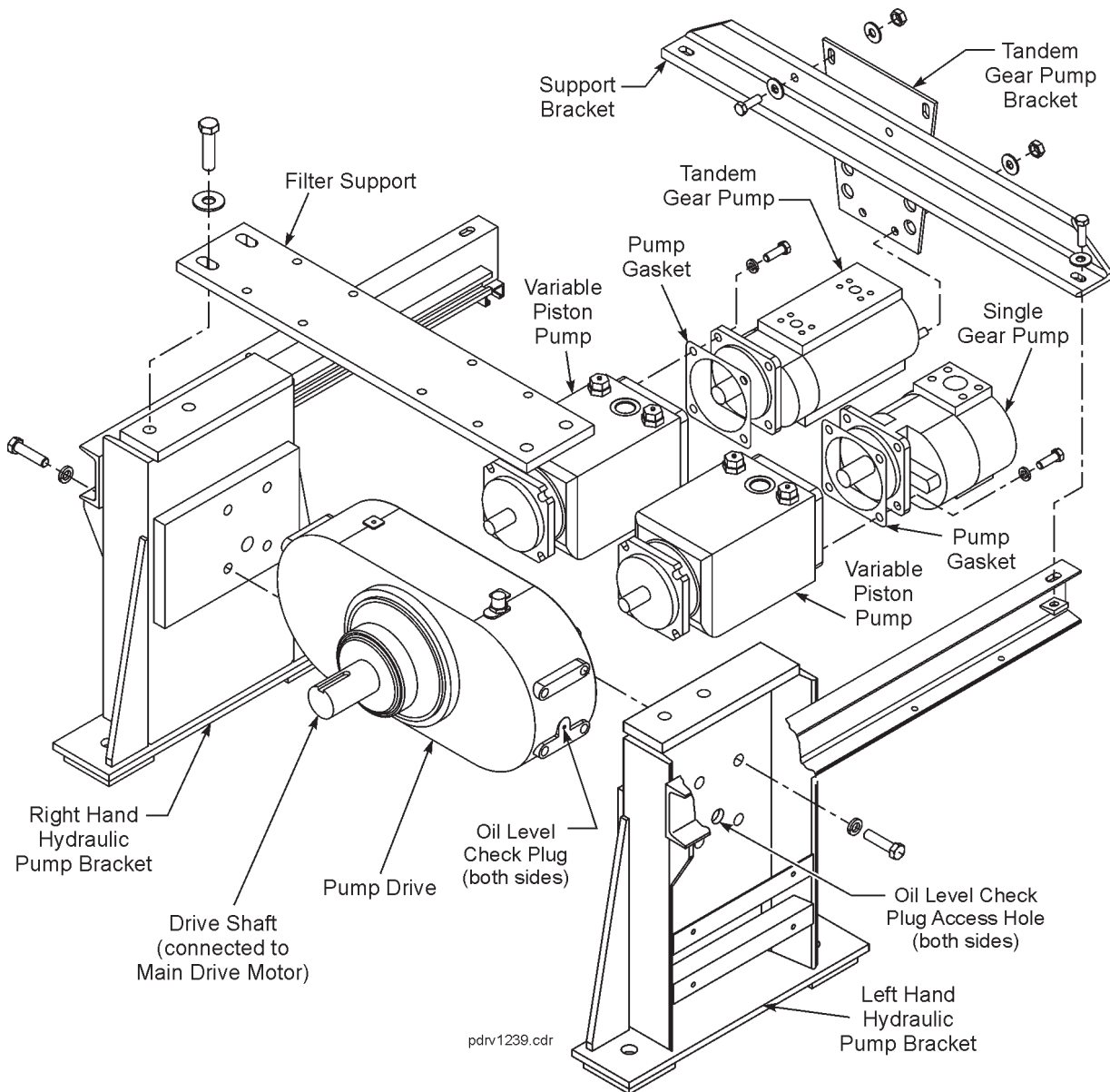
CAUTION: If working on a rear jack, refer to steps 5 through 8 and 15 through 31. If working on the front jacks, refer to steps 9 through 31.

5. For rear jack repair, with an open-end wrench, remove the female half of the quick disconnect from the male half that is attached to port PR of the counterbalance valve. Leave the 1/4" hose attached to the female half of the quick disconnect.
6. When step 5 has been completed, disconnect the 1/4" hose at the electric junction box.

HYDRAULIC PUMP DRIVE

The hydraulic system pumps are driven by the main air compressor motor through a gearbox. The gearbox is mounted to the compressor base.

The oil level in the gearbox should be checked weekly and oil added if required. Daily check the gearbox for oil leaks and repair as required.



Hydraulic Pump Drive

To remove and disassemble the pump drive gearbox, proceed as follows:

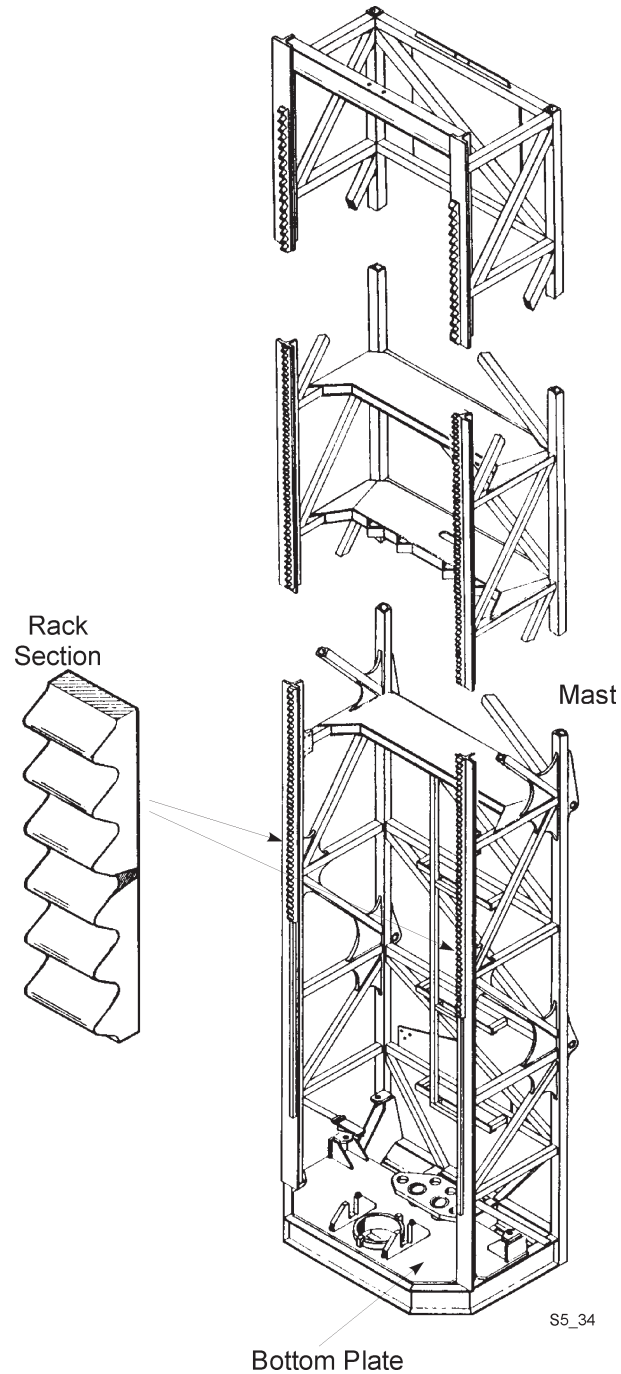
1. Place the machine in a secure area to perform the repair. Shut off and tag the controls.

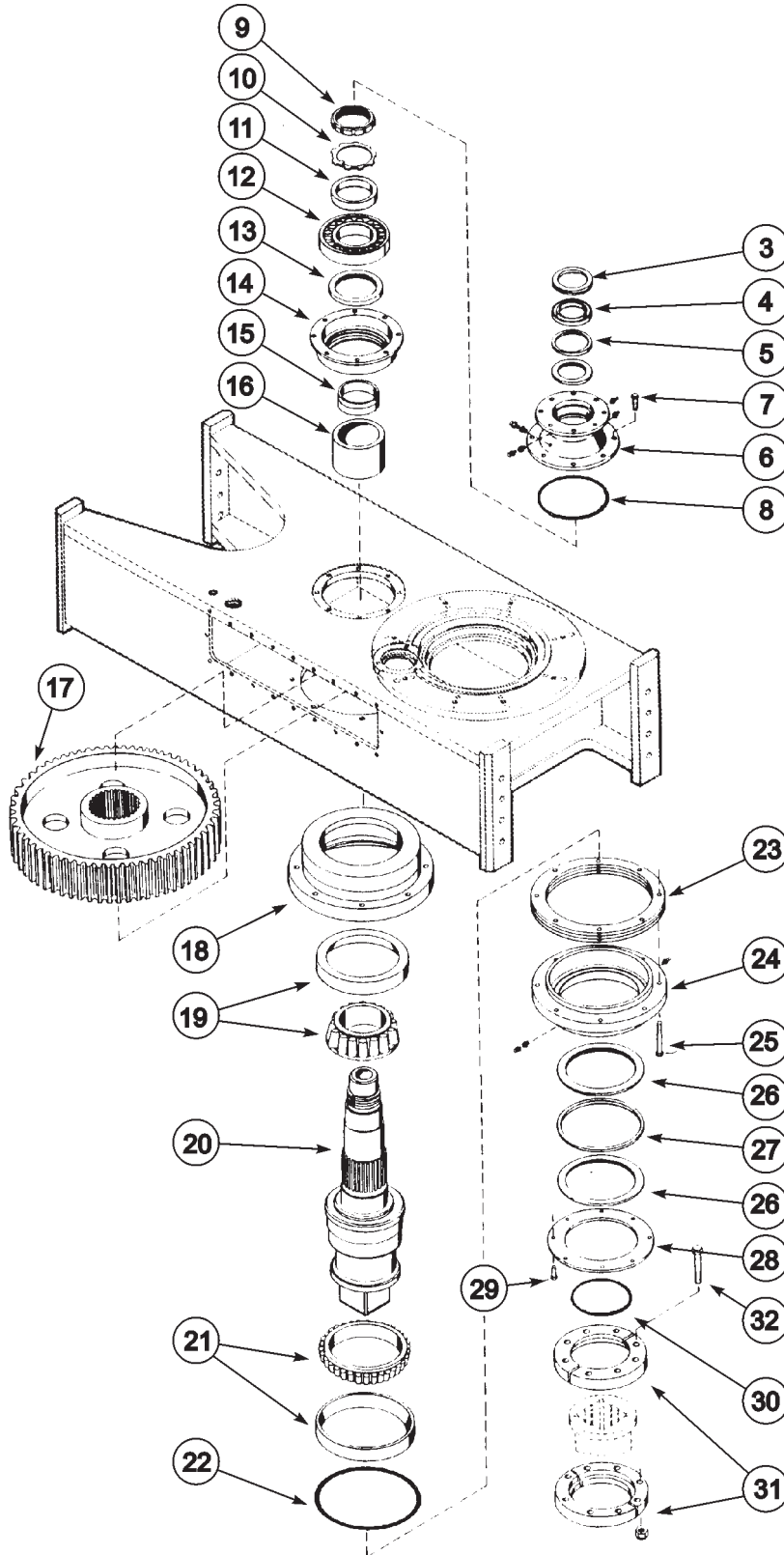
MAST STRUCTURE

The mast is a fabricated structure made of steel tubes and formed plates. The structure is formed by four vertical tubes tied together on three sides with tubular lacing. The fourth side is open to allow the rotary drive unit to be raised and lowered the length of the mast.

Inspect the structure daily for wear or damage. Inspect all mast ladders and platforms for loose hardware and structural integrity. Inspect the racking on the outside of the rear mast tubes for proper lubrication and any wear or damage. Inspect the mast hinge pins and the structure surrounding the pins for wear or damage. Verify that the hinge pin keepers are in place and tight. Inspect the mast hoist cylinder attachments for wear or damage. Lubricate the pins weekly with the appropriate lubricant. Inspect the mast lock pins for wear and damage. Verify that the lock pin hydraulic cylinders and hydraulic line are not leaking.

Every 80 operating shifts lower the mast and inspect all welds thoroughly for cracks or damage. Clean the racking on the outside of the two rear mast tubes and check the welds securing the racking to the tubes.





- 3. Swivel Seal
- 4. Seal Spacer
- 5. Oil Seal
- 6. Swivel Housing
- 7. Housing Bolt
- 8. O Ring
- 9. Lock Nut
- 10. Lock Washer
- 11. Bearing Spacer
- 12. Upper Bearing
- 13. Oil Seal
- 14. Bearing Carrier
- 15. Seal Sleeve
- 16. Gear Spacer
- 17. Drive Gear
- 18. Bearing Carrier
- 19. Top Lower Bearing
- 20. Shaft - Upper Section
- 21. Bottom Lower Bearing
- 22. O Ring
- 23. Shims
- 24. Bearing Retainer
- 25. Retainer Bolt
- 26. Oil Seal
- 27. Seal Spacer
- 28. Seal Retainer
- 29. Retainer Bolt
- 30. O Ring
- 31. Shaft Clamp Collar
- 32. Collar Bolt

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Rotary Machine Driveshaft - Details



REPAIR

Repair of the rotary/pulldown guide frame is limited to replacement of worn or damaged components. Repair welding of any of the components is not recommended. Since only limited repairs to the guide frame are possible with the unit installed on the machine, it is assumed for the purposes of this manual that the entire rotary/pulldown unit will be removed from the machine prior to repairs. Replacement of the rack pinions and guide rollers is possible without removal of the entire guide frame from the machine. The repair procedures for these components are included in the following procedures.

To remove the guide frame assembly complete with the rotary gearcase and pulldown machinery from the machine, proceed as follows:

1. Lower the rotary drive unit to its lowest position and rest it on the lower mast stops. Open the auxiliary power and control breakers and tag all controls to prevent unauthorized operation.
2. Remove the upper air pipe from the swivel housing and from the guide angle. Discard the gasket. Use new gaskets at reassembly.
3. Disconnect the electrical leads to the rotary and pulldown motor and remove the cable from the drive unit.
4. Disconnect and remove the lubrication hoses leading to rotary drive unit, if so equipped.
5. Using a suitable crane and rigging, support the entire rotary/pulldown unit.
6. Remove the upper and lower front guide roller eccentric pin handle anchor bolts and turn handles to back off on the tension on the rollers to the mast.
7. Remove the capscrews that secure wear plate.
8. Remove the capscrews that secure bearing to the eccentric pins.

NOTE: To remove the retainer capscrews it may be necessary to rotate the eccentric pin to gain access to the capscrews.

9. Support the upper bogie rollers and lower front roller, then using the pin handles, pull the upper and lower front eccentric pins from the rollers, bearing housings and guide frames.
10. With the crane and rigging installed in Step 5, lift the rotary/pulldown unit from the mast and place it on secure blocking.



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 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.
26. Remove seal retainer from the brake side of the gearcase. Remove gasket and oil seal from the retainer.
27. Clean and inspect all parts and repair or replace all damaged or worn parts. Reassemble in reverse of disassembly noting the following:



CAUTION: During reassembly of the pulldown gearcase certain items must be heated or cooled for assembly purpose. When heating or cooling the items take all necessary precautions and use suitable protective equipment when handling the heating or cooled items.

- a. The input shaft bearings, bearing spacer and coupling half are interference fit to the shaft and will require heating to install.
- b. Use thread locking compound on the brake hub retainer capscrews, the coupling end bearing oil seal retainer capscrews and the brake drive ring mounting capscrews. Torque drive ring mounting capscrews to 140-150 ft-lbs.
- c. Fill the cavity between seals with lubricant at assembly.
- d. The second intermediate shaft bearing and gear are interference fit to the shaft and will require heating to install.
- e. Use thread locking compound on the encoder end bearing retainer socket head capscrews.
- f. The first intermediate shaft should be assembled as follows:



WEEKLY MAINTENANCE CHECKS

Check for correct operation of all components of the system. Valves, cylinders, and motors and pumps should operate smoothly, with no jerking or binding. Check the oil level in the reservoir. The reservoir should be almost full (108 gal.) when the mast is horizontal and all other cylinders are retracted. With the mast vertical and all other cylinders retracted, the reservoir should be slightly below 7/8 full.



CAUTION: Before topping off the fluid in the hydraulic tank, verify that the mast cylinders are extended and all other cylinders are retracted. Failure to comply with the above (i.e. jack cylinders extended) will overfill the tank when the jack cylinders are retracted and will cause the tank to rupture.



CAUTION: Do not operate with low oil level. Operating with low oil level can cause cavitation and air pockets. This will cause faulty operation and can also cause damage to the system components.

Inspect all components and lines to be sure they are in good operating condition. Check for obstructed or distorted cylinders. Inspect the system for leaks. If a leak is found, tighten the screws or fittings around the leaking area before beginning major repairs. If that does not stop the leak, it may then be necessary to repair or replace the leaking part.

OIL RESERVOIR REPAIRS

The hydraulic oil reservoir is epoxy coated on the inside to prevent scale and oxidation.



CAUTION: DO NOT weld on the reservoir; it will damage the coating.

LEVELING JACK COUNTERBALANCE VALVE PRESSURE RELIEVING PROCEDURE

If it becomes necessary to work on the leveling jack counterbalance valve for any reason, relieve pressure in the cylinder using the following procedure:

1. Position the machine with crawlers on the ground and jacks retracted so that the jack pads are approximately one inch off the ground.
2. Turn off the hydraulic pump and relieve any pressure in the system by loosening the reservoir breather. When trapped air in the reservoir is relieved, immediately replace the breather.



BIT VIEWING HATCH CHECK

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

BOARDING STAIR CHECK

Check function of boarding stair with switch in operator's cab. Stairway should raise and lower smoothly with no chattering action.

MAIN FLOW VALVE CHECK

1. With 0-1,500 PSI gauge at test port 26 and with pumps running, set backpressure relief to see 300 PSI.
2. With 0-1,500 PSI gauge at test port 23 and with pumps running and all valves de-energized, record pressure observed.
3. With 0-7,500 PSI gauge at test port 23 and with 0-1,500 PSI gauge at test port 26, start pump and energize main flow valve (MFV) via hydraulic test function. Adjust relief valve of center sandwich valve at station 1 to see 3,000 PSI at test port 23. Record pressure at ports 23 and 26.

BREAKOUT WRENCH AND TOOL WRENCH CHECK

Check function of breakout wrench and tool wrench with switches in operator's cab.

DUST CURTAIN CYLINDERS

1. Check function versus switch position.

NOTE: After 3 - 5 cycles, operation should be smooth with no jerkiness or chattering.

2. Adjust door stops.



DRILLING PLATFORMS AND DUST CURTAINS

- Daily inspect the dust curtains for tears and other damage. Replace worn or damaged curtains.
- Check the curtain raising ropes for broken or frayed ropes. Replace broken or damaged ropes.
- Check the dust deflector seal which fits around the drill pipe for damage. Replace if damaged.
- Check the curtain raising lever mechanism for proper operation. Lubricate all pins once a week.

WATER INJECTION - OPTION

The maintenance of the water injection system consists mainly of keeping the water tank full of clean water, checking weekly that the pump and valves are operating correctly, and that all hoses and fittings are not leaking.

OPERATION

With the operating mode switch in the DRILL position, the main compressor operating, and butterfly valve open, turn switch WIS on the operator's console to the ON position. Close the air operated drain valve located in the tank.

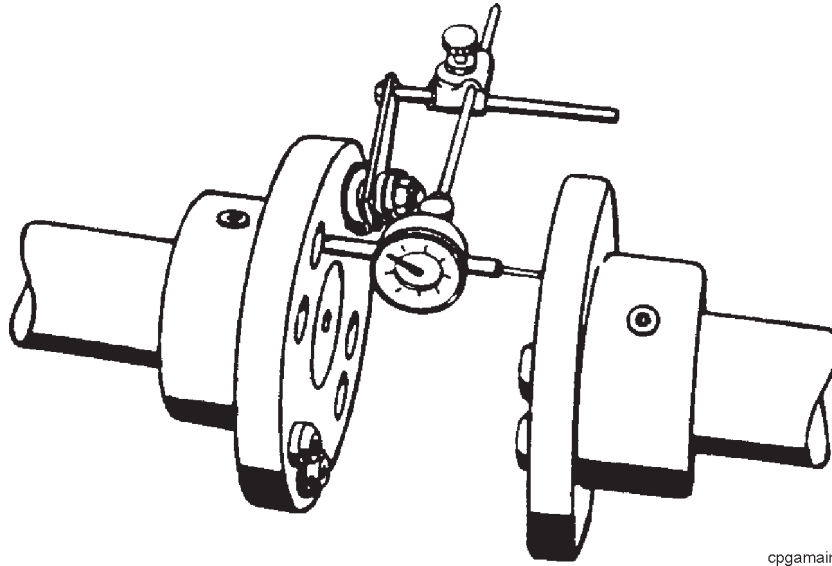
The water pump is a variable speed pump driven by an AC motor and controlled by a variable frequency drive. The amount of water supplied is governed by the speed of the pump motor. Moving switch WIR on the operator's console CW will increase the amount of water. Full CW will supply the maximum amount of water.

Because the pump is submerged below the water in the tank, the water will begin pumping immediately. Water will flow from the pump through a flow control valve back to the tank. Once the water pressure increases over 30 PSI [check-valve cracking pressure] and overcomes air pressure from the mast air line, the water will begin to flow to the mast air line. Water will continue to flow until the water injection system is turned OFF or the main butterfly valve starts to close.

When the water injection system shuts down for any reason, the WIC valve will de-energize and the drain valve in the tank will open to drain the system by gravity.



ANGULAR MISALIGNMENT



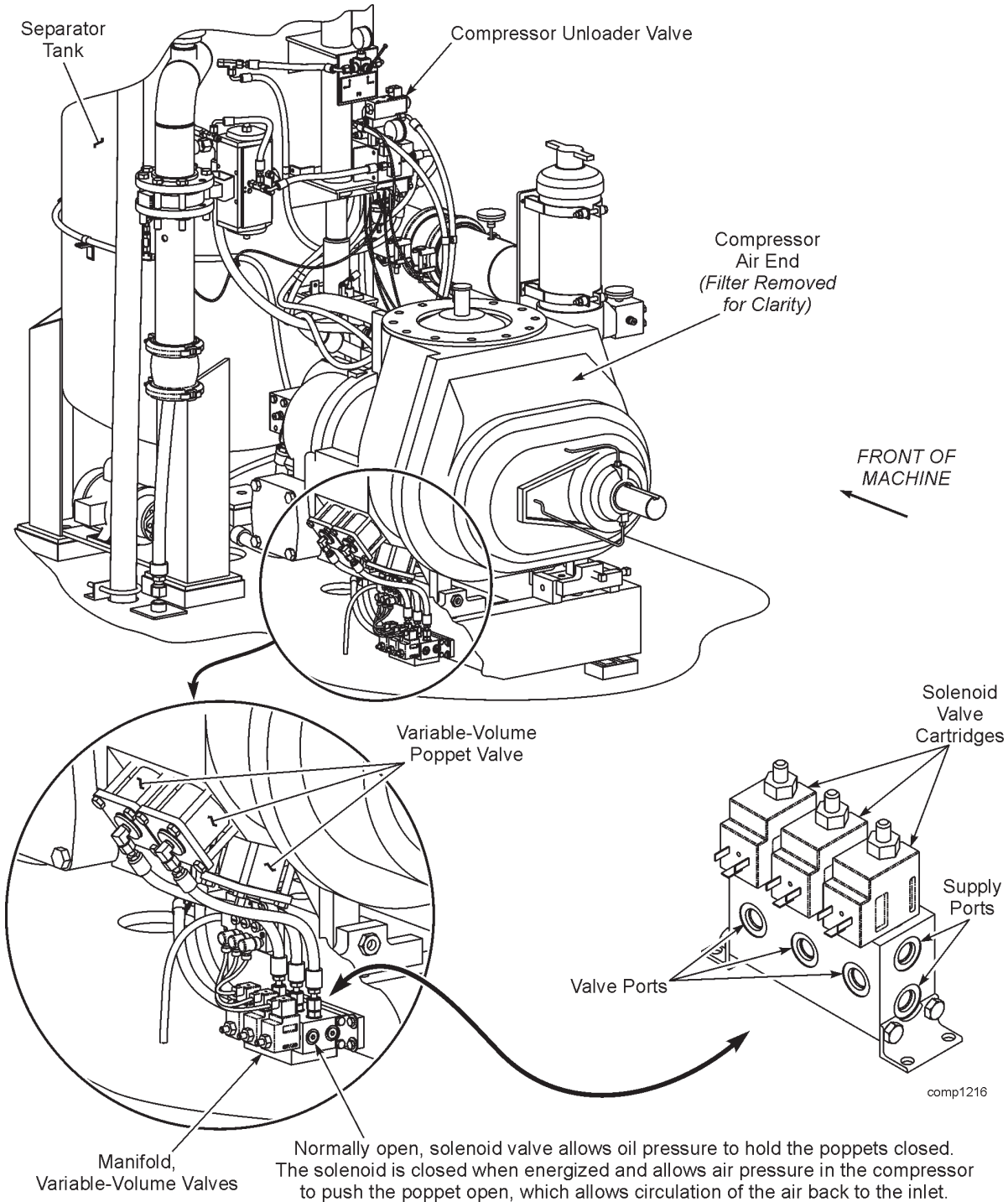
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Checking for Angular Misalignment

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.

NOTE: After adjusting the variable volume control, especially when reducing the compressor CFM by a large amount, make sure the tank pressure while drilling is greater than 30 PSIG. This will avoid excessive oil carryover.

Refer to the figure below for variable volume component locations.



Removal, clean and test the thermostatic control valve as follows:

1. Shut down the compressor. Lockout and tag the compressor controls. Allow the system to cool if at all possible. Drain the oil. Relieve the oil pressure in the lines to and from the thermostatic valve.
2. It may be necessary to remove the thermostatic valve from the machine in order to separate the components. However this is not required. At least disconnect the compressor supply hose at valve port A.



DANGER: STORED ENERGY! At operating temperature, the hydraulic fluid is hot and pressurized. Hot hydraulic fluid may cause burns. Hydraulic fluid under pressure may cause injury or death if not released in a controlled manner before the lines are disconnected.

3. Remove the four bolts and lockwashers attaching the adapter housing at port A.
4. Remove the adapter housing and O-Ring.
5. Remove the thermostatic element assembly and seal.
6. Clean the element and test as follows:



CAUTION: The valve housing and thermostat may be hot. Use suitable protective equipment when handling any hot items.

7. Place the element in 150°F (65°C) water and stir the water vigorously with the element for 5 minutes. Immediately place the element in the housing. If the element is fully stroked, the seating of the element against the upper housing can be felt. If the element is not fully stroked and seated, replace with a new element, [140°F (60°C) setting].



CAUTION: Replacement element must be the same as the original. Do not replace with other brands.

8. Clean the internal surfaces of the adapter housing and the main valve housing.
9. Lubricate a new O-Ring and slide it over the top of the element assembly and into position on the element.
10. Place a new housing gasket in the recess of the main valve housing.
11. Insert the element into the adapter housing. Install the adapter housing over the element.
12. Install the housing capscrews and lockwashers and tighten. Refill the oil in the system. Remove the compressor lockout and restart the compressor. Test for leaks and for proper operation.





WELDING AND CUTTING EQUIPMENT

The welding and cutting equipment needed for general repair welding is listed below.

WELDING MACHINES, Arc - 600 ampere (for Welding and Air Arcing)
 OXY ACETYLENE TORCHES with Gauges - 150' Long Hoses
 HEATING TORCHES, Butane (for Boom Welding)
 ARC AIR ATTACHMENTS (for use with 600 Ampere Welding Machines)
 WELD RODS - E7018, E8018, E11018 - 1/8", 5/32", 3/16", 1/4"
 CO₂ - Welding Grade - 45°F Max. Dew Point
 OXYGEN - Cutting, and Heating
 ACETYLENE
 WELD FLUX CHIPPERS - Pneumatic with Chisels and Spare Parts
 BLOWERS, Ventilating (for Compartment Welding,)
 GRINDERS, Wheel - Air Powered w/Wheels
 TARPAULINS - Fireproof (for Boom Welding Shelters)
 ASBESTOS GLOVES
 CUTTING GOGGLES, Dark
 SOAPSTONE MARKERS
 ANTI-SPATTER COMPOUND
 TEMPILSTIKS - 200° and 200°

STRESS RELIEVING & TEMPERATURE MEASURING EQUIPMENT

The equipment recommended for stress relieving, after repair welding, is listed below.

TEMPERATURE MEASURING EQUIPMENT
 SPEEDOMAX, "W" Multipoint, Potentiometer Recorder
 POWER REQUIREMENT - 120 Volts, 60 or 50 Hz.
 RANGE - 0 to 1500°F
 CALIBRATION - Chromel-Alumel Thermocouple Wire
 ACCURACY RATING - 0.3% of Electrical Span
 CHART SPEED - 2" per Hour
 THERMOCOUPLE SELECTION - Six (6) Points
 FLUORESCENT LIGHTING
 MANUFACTURER - Leeds & Northrup Company

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