



System Operation Manual

MD6640 Blast Hole Drill

Serial Number DR612185

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Introduction

GENERAL INFORMATION

This manual is designed to assist the owner in the operation of this machine. By following easy to understand step-by-step procedures the operators can perform all tasks in a safe manner.

THIS MANUAL IS NOT THE PARTS BOOK, and cannot be used as reference material to order parts. A separate, detailed parts book has been supplied. Please carefully read the instructions in it. All parts are listed by group and/or product code numbers with the associated item/part numbers for THIS SPECIFIC MACHINE. Order parts in the exact quantity needed. RIGHT and LEFT refer to machine locations as viewed by the operator sitting in the operator's seat in the cab. Please state the correct machine SERIAL NUMBER when corresponding or contacting the factory service or parts departments. Records on each machine are filed by serial number and when given this number, your machine's specific design and original equipment is accessed quickly by the Caterpillar Global Mining parts representative. Periodic additions or revisions may be made to this manual. Should you require additional information or factory service assistance contact your regional service representative or:

Caterpillar Global Mining, LLC
Mining Products Division
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Denison, TX 75020
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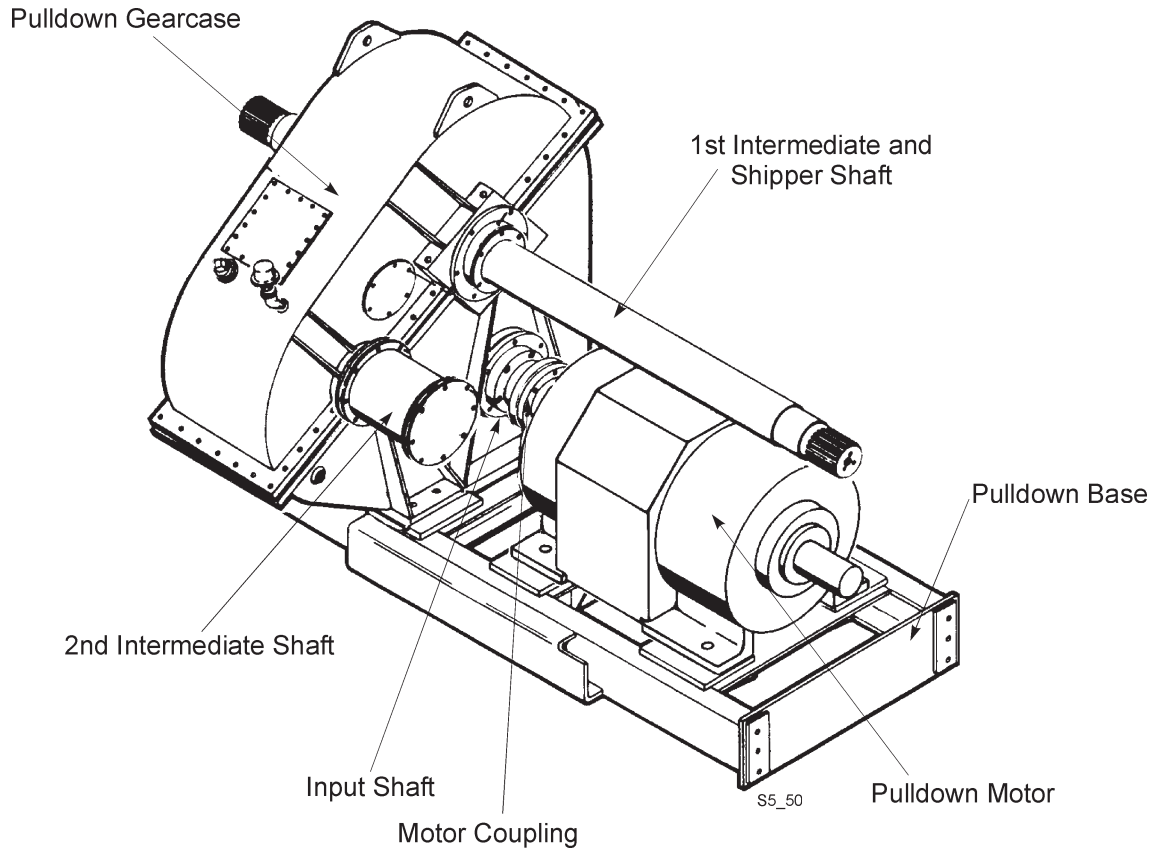
The company reserves the right to make changes or add improvements to its machines at any time. This will be without incurred obligations to install such changes on machines sold previously. Due to this ongoing program of product research and development some procedures, specifications and parts may be altered in a constant effort to improve our machines.



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Stored Energy Signs

PULLDOWN GEARCASE



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ROTARY DRIVE SPEED SELECTOR SWITCH

The rotary speed selector switch is a three position switch located above the rotary rheostat. This switch determines the speed/torque range of the rotary motor. In the LOW position, the motor has the highest torque capability but is limited in speed to about 85-100 RPM at the bit. In the HIGH position, the motor has a higher speed capability (110-140 RPM range) but motor torque will be less (typically 68% to 74%). The MEDIUM position provides for operation between the HIGH and LOW positions.

The switch should be set to the range that most closely matches the desired bit speed range. The LOW setting is sufficient for most conditions. If more speed is desired, select the desired range as needed.

HOIST/PULLDOWN RHEOSTAT

The hoist/pulldown rheostat controls the speed and direction of the hoist-pulldown motor for hoisting or lowering the rotary drive unit.

Turning the rheostat in the hoist direction from the “0” position will raise the rotary drive unit. Maximum speed is available at full clockwise position.

Turning the rheostat in the pulldown direction from the “0” position will lower the rotary drive unit. Maximum speed is available at full counterclockwise position.

NOTE: The rheostat utilizes a reference scale and pointer. When the rheostat is turned, the pointer indicates, on the reference scale, the relative percentage of full speed being set.

The panels with controls as shown on the following pages are typical of what could be included on a console.

DUST CONTROL ON/OFF SWITCH — OPTION

The dust collector switch is a two position switch used to start the fan on the dust collector hopper. When the switch is in the OFF position, it will shut the dust collector fan motor off.

DUST CURTAIN SWITCH — OPTION

The dust curtain switch is a two-position switch. Turning the switch to the UP position will raise the dust curtains. Turning it to the LOWER position will lower the dust curtains.

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functionality of the operator display and it's interface with the machine's PLC controller. They have no effect on machine operational use.

All of the machine controls can be found on the Operator's Display Panel touch sensitive screen or the left and right Control Consoles of the operator's seat.

DISPLAY SCREENS

The information provided in the central area of the title screen is machine specific and lists the machine serial number and a copyright notice relating to the control and display software.



Main Menu Icons
(all screens)

TITLE SCREEN

The Main Menu Icons appear at the bottom of all screens allowing quick navigation.

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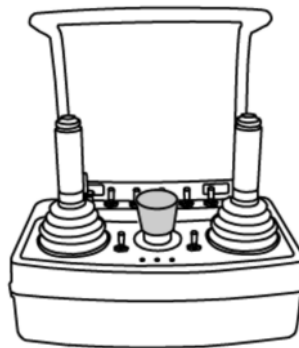


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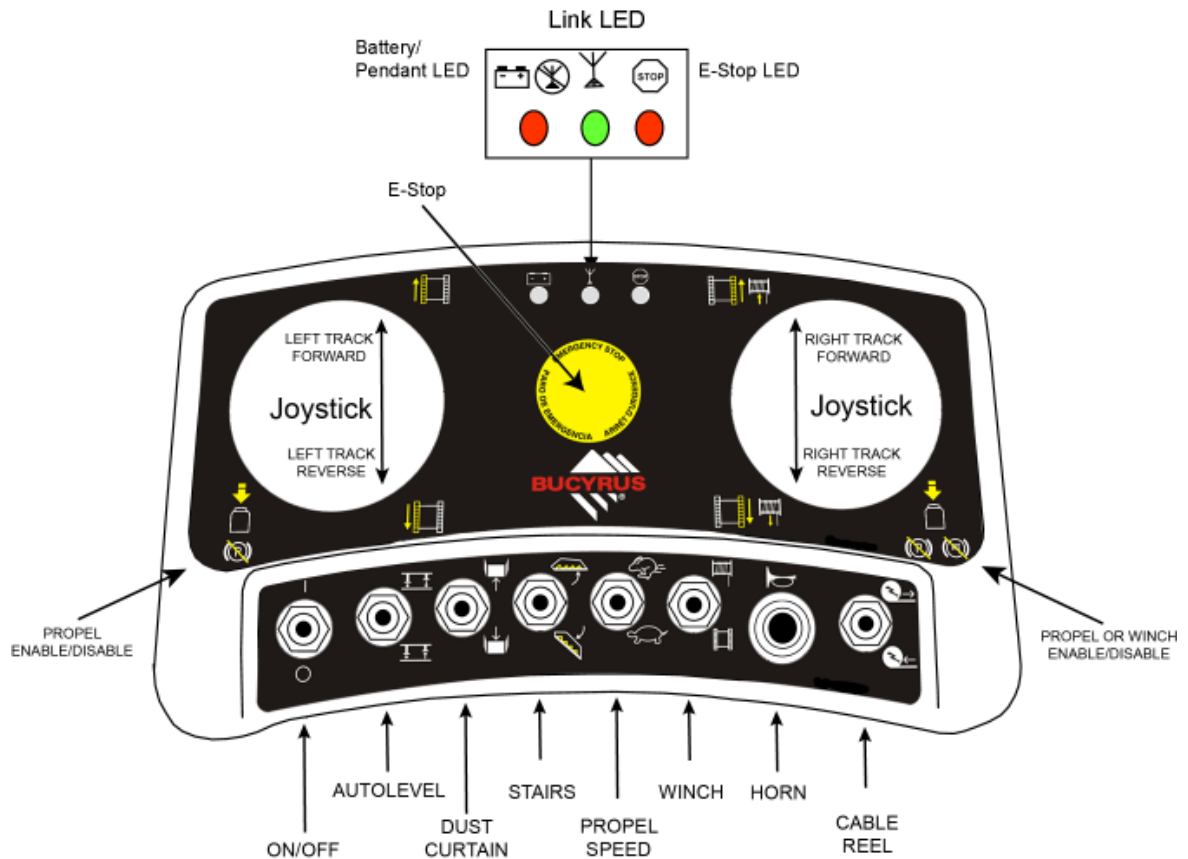
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RADIO REMOTE PROPEL STATION (Optional)



The radio remote propel station is located in the operator's cab. To enable the station, position the operating mode switch located on the left control console to Remote Propel. The station includes two joysticks, one for each crawler frame; an emergency stop push-button; function selector switches as described below; and an indicator which will light up when communication is established between the transmitter and the receiver. There is also an indicator light for the status of the e-stop and the battery charge.



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PROPEL PROCEDURE

Before beginning the propel operation, the operator should first inspect the travel route for large rocks, deep ruts, or uneven contours. When working on a grade, verify the slope and compare to the allowable maneuvering slope limits at the end of this section.



CAUTION: Do not attempt to maneuver or steer the machine on grades which exceed the allowable maneuvering slopes without consulting the special propel section. Failure to follow these instructions could result in a machine tip-over, damaging the equipment and resulting in possible serious injury or death.

The operator's display terminal leveling/propel screen should be monitored during propel to make sure the allowable machine stability limits are not exceeded.

Once it has been verified that the travel route is in good condition, the machine is now ready to propel.

NOTE: This machine should only be propelled long distances with the mast fully lowered, fully raised and locked, or locked at an ANGLE HOLE setting.

For long propels of 1,000 feet (304.8 meters) or more, or if the machine is to be propelled over grades which approach the allowable stability limits, the tool string should be disassembled, the rotary drive unit lowered, and the mast lowered. This achieves the most STABLE condition for a machine against tipping and also reduces stresses in the mast structure.

For long propels of 1,000 feet (304.8 meters) or more, the temperature of the undercarriage components should be monitored. The lower rollers, take-up tumblers and propel planetaries should operate below 95 degrees C. The propel motor should operate below 90 degrees C. If these temperature limits are reached, stop the machine and allow the track components to cool down. Note that propelling in low speed reduces the heat build up in these components.

If while propelling with the MAST-DOWN and the HEAD-DOWN the drill starts to list, it will continue to list until the upper works contacts the pivotal axle. The machine will reach equilibrium when the upper works contacts the pivotal axle and WILL NOT TIP OVER. With the mast-down and the head-down, full listing will NOT cause the machine to tip over. The operator should attempt to propel toward a more level area on the bench to correct this condition.

All of the stability values shown are based on a fully loaded machine (i.e. full water tank, cable on cable reel, full compliment of specified pipe, all oils and operating fluids) as originally specified by the Customer and shipped by Bucyrus International, Inc.

This machine is propelled using the controls on the operator's console in the operator's cab or radio controlled from the remote propel station outside the machine.

MAST RAISING

CAUTION: Raising or lowering the mast is a two-person job. Do not attempt to raise or lower the mast without the assistance of a helper familiar with the procedures involved.



CAUTION: During the mast raising procedure personnel should be kept clear of the machine and the area immediately surrounding the machine, especially the front of the machine. No one is to be allowed on the mast, operator's cab roof, or machinery house roof while the mast is in the air. Failure to heed this caution may result in the death or serious injury of personnel struck by the mast should it fall for some reason.



CAUTION: Limitations exist as to the length, diameter, wall thickness and number of drill pipes that may be stored in the pipe racks when raising or lowering the mast. Refer to the pipe size limitation chart in the appendix before attempting to raise or lower the mast. Failure to comply with these limitations will overload the mast, mast support and hydraulic system possibly causing loss of control of the mast.

1. Inspect the mast and machine exterior to ensure that all wires, hoses, cables, etc. are clear of the machine to prevent damage to the machine or equipment during the raising procedure. Check that the mast cylinder pins, mast hinge pins, and mast brace pins are in place and secured. Verify on the operator's display terminal operator's display screen that no reference to A-frame pins is shown. Verify that the operating mode selector switch is in the DRILL mode.
2. The main air compressor motor must be energized. Move the operation selector switch to the MAST/WINCH position. Slowly raise the mast by lifting and then slowly pushing the mast joystick, located on the right control console, forward. As the mast reaches an angle of 70 degrees it will begin to go over center and tend to come into the vertical position by itself. Care should be used once the mast has gone over center since the speed of the mast will increase sharply.



CAUTION: The mast joystick should be moved away from and returned to the neutral position very slowly. Sudden starts and stops can be damaging to the mast and hydraulic system. Be extremely cautious as the mast approaches 70 degrees as once the mast goes over center only a very slight movement of the joystick is necessary to cause motion in the mast.

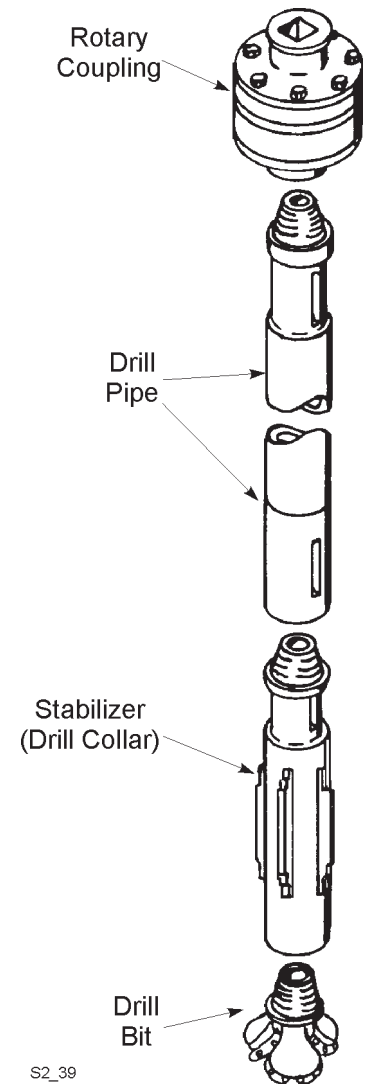
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DRILL TOOL STRING ASSEMBLY

The tool string consists of one or more sections of drill pipe, a stabilizer (drill collar) and a bit. In assembling the tool string, the stabilizer is the first item installed, then comes a section of drill pipe and finally the bit.

To install the stabilizer proceed as follows:

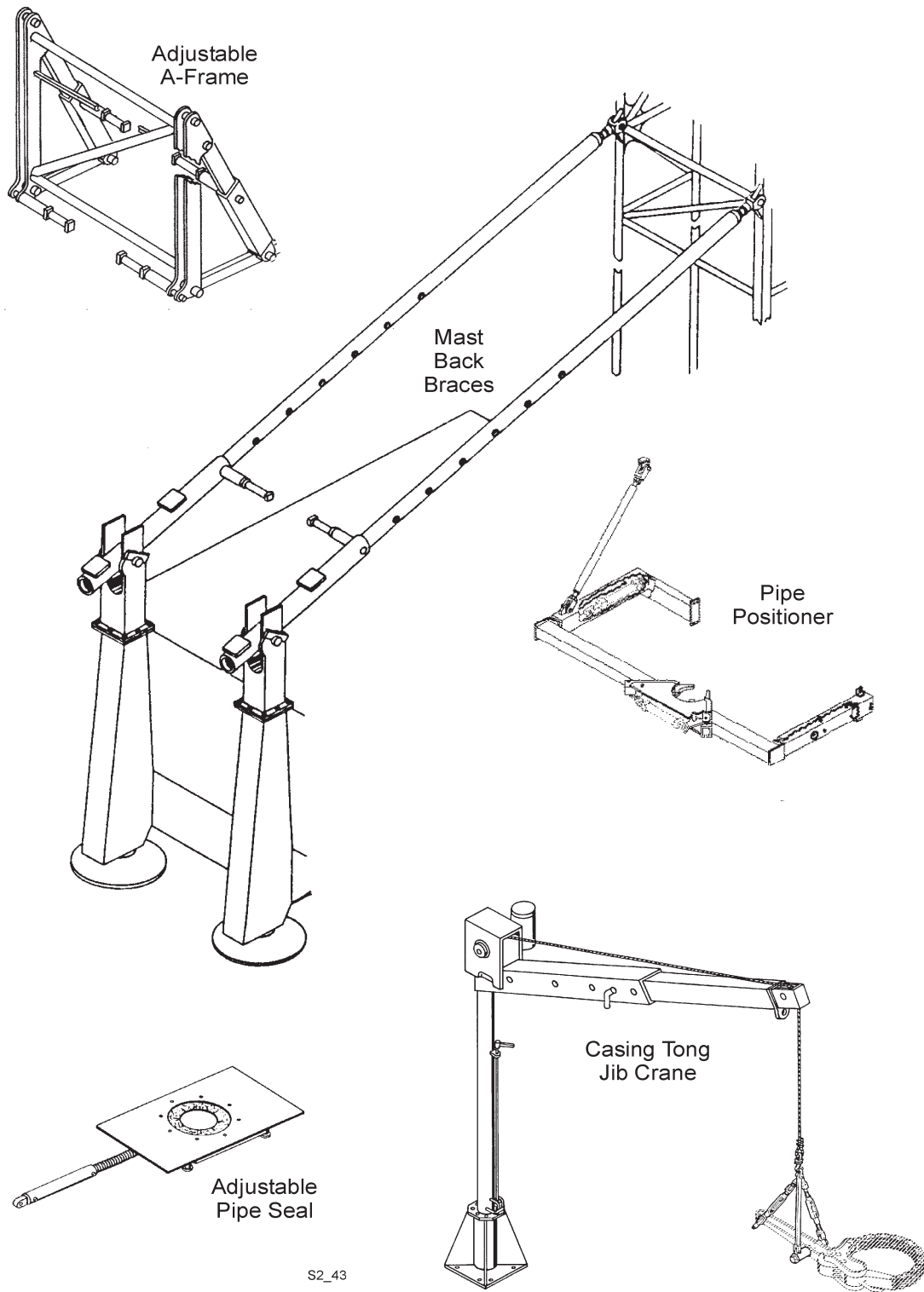
1. Place the stabilizer to be installed in a position so as to be accessible to the auxiliary winch line. Clean and lubricate the threads and shoulders on each end of the stabilizer. Install a lifting bell on the pin (upper) end of the stabilizer and lift it onto the drilling deck with the auxiliary winch line. Securely block the stabilizer horizontally on blocking sufficient enough to place the stabilizer 8-10 inches above the drill deck. Remove the auxiliary winch line.
2. Remove the guide bushing from the hole in the drill deck. Place the guide bushing on the upper end of the stabilizer with the tapered end of the bushing toward the lower (box) end of the stabilizer. Reattach the auxiliary winch line to the lifting bell.
3. Install the stabilizer and drill bushing in the hole in the drill deck. Make sure the drill bushing is seated properly. Lower the stabilizer until the slots in the stabilizer are aligned with the tool wrenches. Extend the tool wrenches to hold the stabilizer in place.
4. Remove the auxiliary winch line from the stabilizer and secure it out of the way. Remove the lifting bell from the stabilizer and store it.



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TOOL STRING

ANGLE DRILLING



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ANGLE DRILLING EQUIPMENT

ENDING THE HOLE (MULTIPLE PIPE SECTIONS)

Reaming the hole with multi-section tool strings is the same as reaming with single pipe section strings. The reaming procedure must be done in stages as the pipe sections are removed.

While removing the drill pipe the cuttings dislodged from the sides of the hole and the cuttings generated by reaming will fall to the bottom of the hole. To effectively clean the hole, it would be necessary to reassemble the tool string and lower it to the bottom of the hole. This is not desirable as it is time consuming. One method to eliminate the need to clean the hole is to overdrill the depth and allow cuttings to fill the hole to the desired finishing depth. Experience in this area will show how much to overdrill the hole. A good practice is to overdrill the hole by 1 to 2 feet (0.3 to 0.6 m) over the estimated finished hole depth. This way, if the estimate is wrong, the hole will be 1 to 2 feet (0.3 to 0.6 m) too deep. This can easily be corrected by a few shovels full of cutting thrown into the hole. Underestimating, on the other hand will require that the tool string be reassembled and the hole cleaned.

DRILLING DIFFICULT FORMATIONS

For the purpose of explanation, the drilling procedure given in the DRILLING section of the manual assumes that drilling takes place in consistent, consolidated rock formation. Unfortunately, not all drilling is in this type of formation. This section of the Operator's Manual will detail, in general, some typical drilling difficulties encountered.

The main cause of difficult drilling are unconsolidated material or wet sticky material. Unconsolidated material causes vibration far greater than experienced in consolidated formation, and if severe enough, may also decrease the bailing velocity of the main air stream. Wet, sticky material causes problems with cleaning the hole since the material may coat the hole and the drill pipe, increasing the air pressure above the working range. Wet material may also plug the bit orifices, freeze the bit cones, or compact into balls that refuse to be bailed out of the hole. The general procedure for drilling in difficult formations is the same as the procedure for drilling in good formations. The hole is collared, drilled, reamed, and cleaned using the standard operating procedures. Monitoring of the machine is, however, critical while drilling in difficult formations.

NOTE: Failure to closely monitor the machine and its bar graphs as shown on the operator's display terminal operator's display screen will result in damage to the machine or a stuck drill pipe.

ATTENDED LONG TERM STORAGE

The attended long term storage procedure combines the short term storage procedure with monthly start-up and running periods. To store the machine for a long period of time it is necessary to complete the procedures listed in the **SHORT TERM STORAGE** topic in this manual. Then, once a month for the duration of the storage period, complete all start-up inspection and lubrication procedures listed in this manual and start the drill. Run all of the gear trains for 10-20 minutes to distribute the oil over the gears and bearings. Hoist and lower the rotary/pulldown unit the full length of the mast 4-6 times to distribute lubrication to the mast and rotary/pulldown unit components. Cycle the tool racks 2-3 times. Run the air compressor for 1 hour. Propel the drill at least 6 times the length of the machine. After running the machine components, follow the short term storage procedure once again and store the machine for another month. Repeat this procedure every month until the machine is returned to service.

UNATTENDED LONG TERM STORAGE

It is not within the scope of this manual to detail the procedures involved in the long term storage of a drill. These procedures will involve disassembly of the major units on the drill, duties that are not usually performed by operating personnel. Refer to the Mechanical Maintenance Manual for details concerning the long term storage of the machine.

The procedure listed here is an outline intended only to give a general idea of the effort involved in proper storage of the machine. To store the unattended machine for an extended period of time, proceed as follows:

1. Complete all short term storage procedures.
2. Remove the motors from the drill and store in a heated building.
3. Completely fill the rotary and pulldown gear cases with an approved oil. Both cases can be filled completely by adding the oil through the breather openings. Remove all water from the cases.
4. Loosen the guide rollers on the rotary/pulldown unit frame to provide one-half inch clearance between the rollers and the mast.
5. Remove the auxiliary winch line.
6. Cover the rotary gear case and hoist/pulldown gear case with a waterproof tarp.
7. Remove the air compressor from the machine and store in an attended heated building.

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