BUCYRUS®

39HR

BLAST HOLE DRILL

OPERATOR'S MANUAL

(Revision Feb. 2007)

Manual No.
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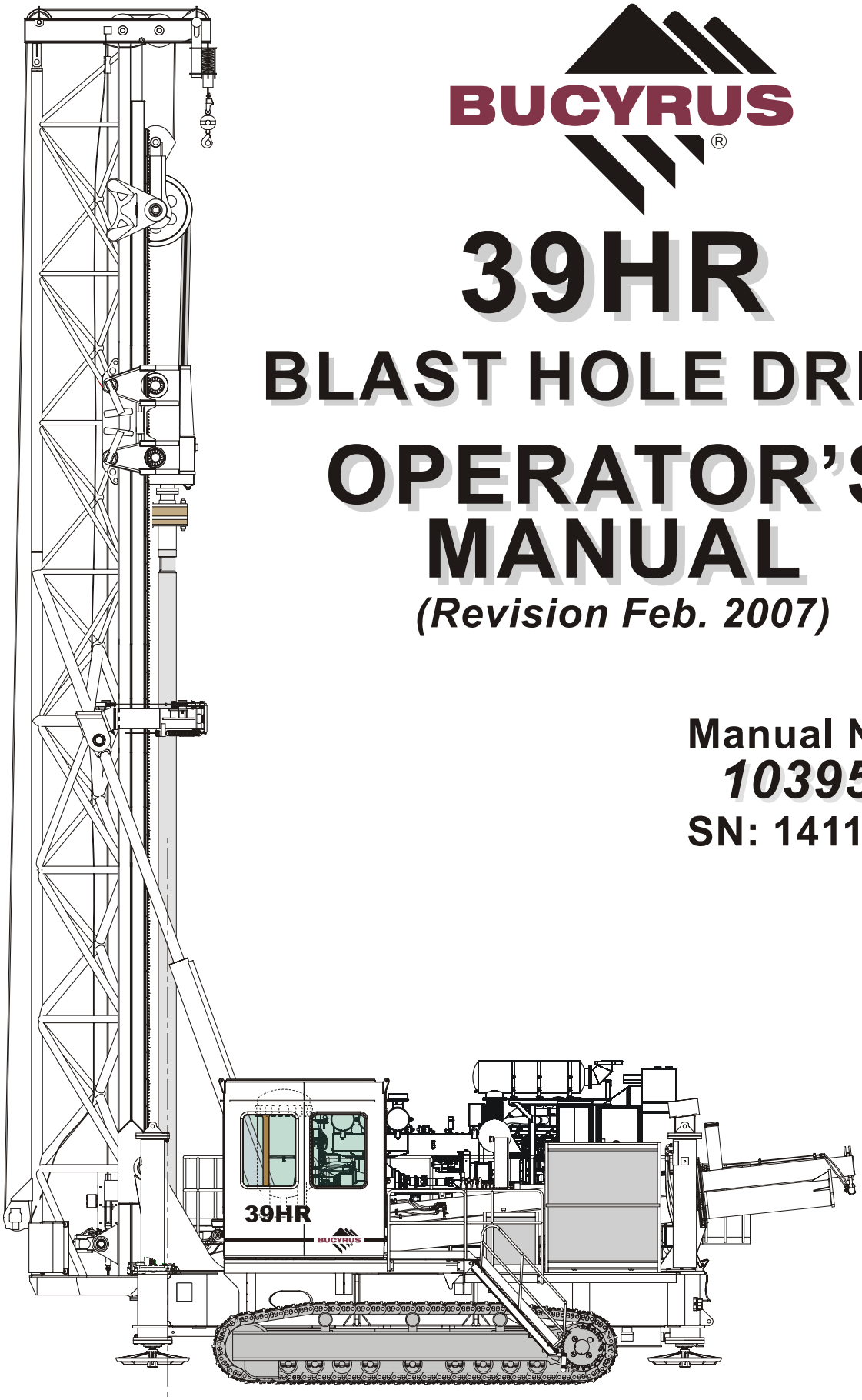

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SAFETY PRECAUTIONS

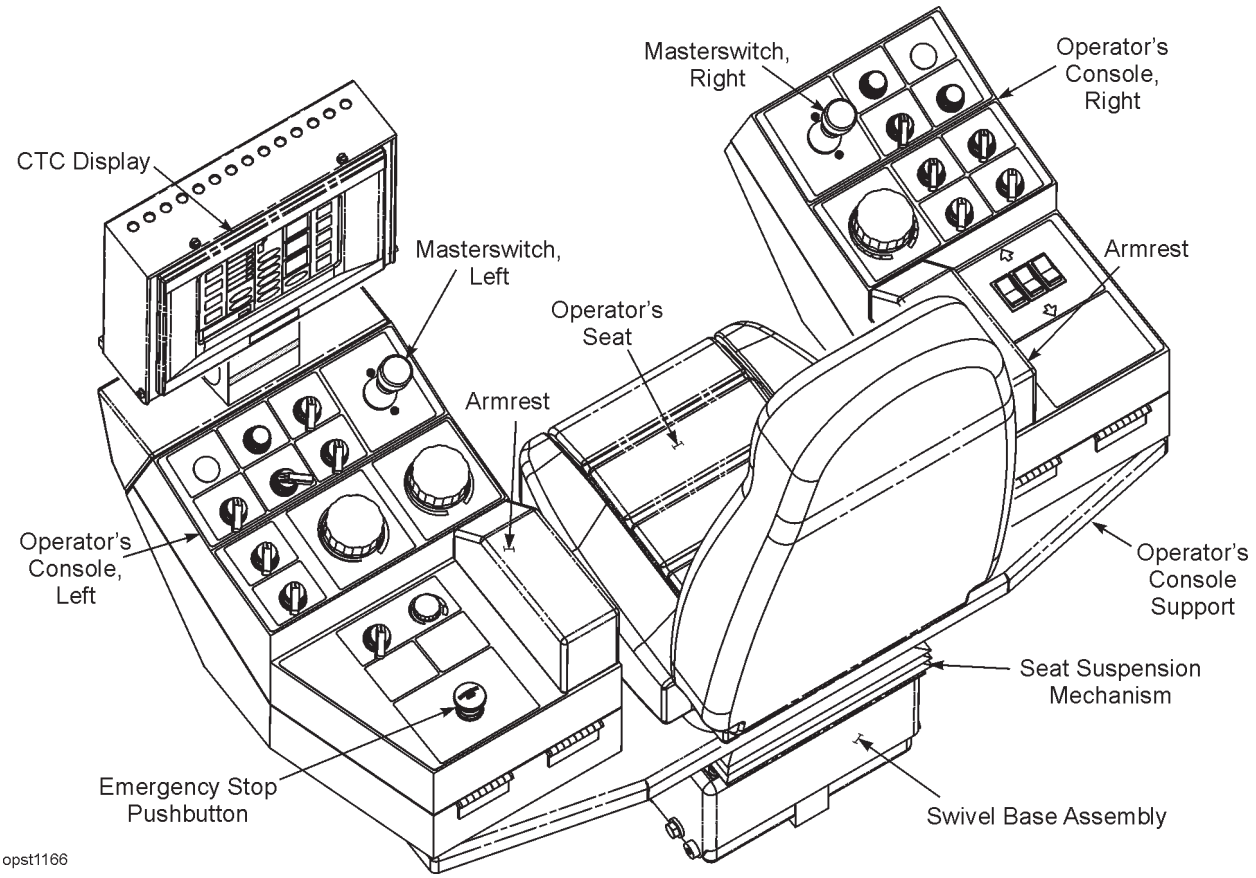
Following the precautions listed below will help to safely maintain or operate any equipment in general.

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 person 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.
- Allow electrical inspection and maintenance to be performed only by a qualified electrician.
- Use extreme caution when working around drilled holes.

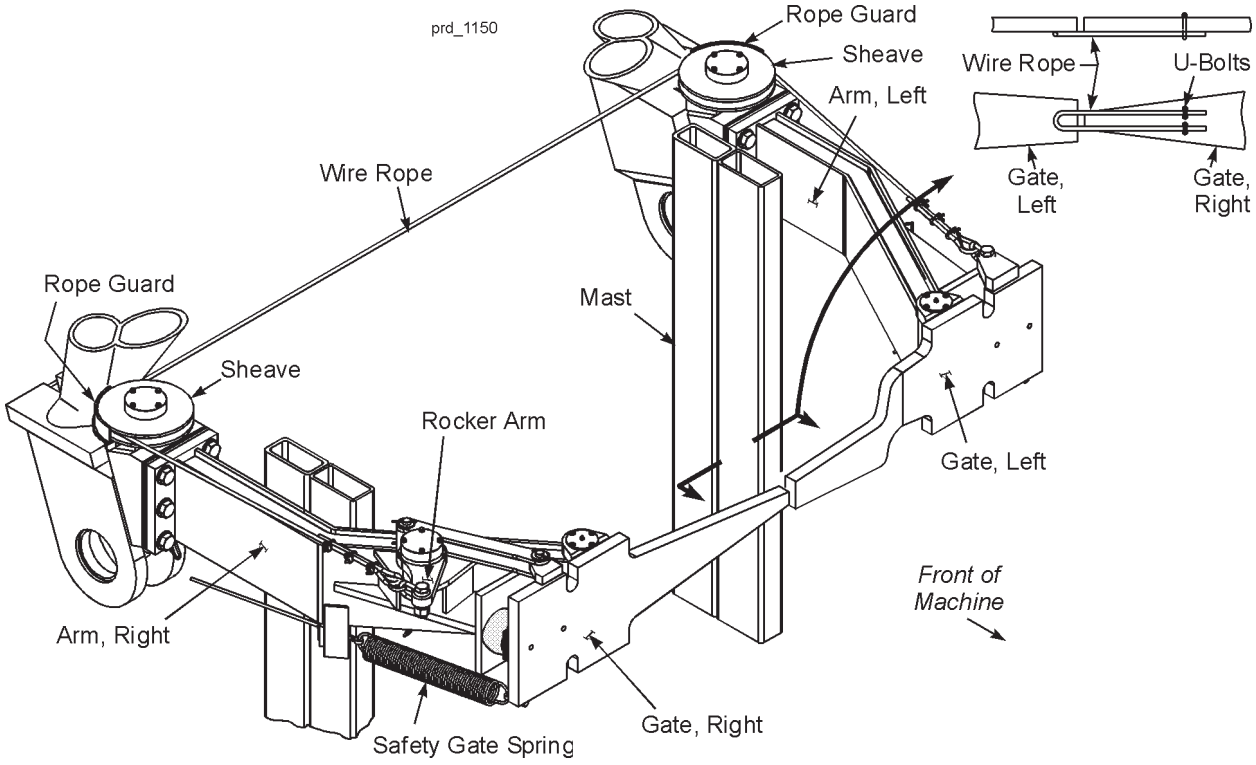
OPERATOR'S SEAT

The operator's seat is a self-contained unit that includes the seat, seat suspension and swivel base assembly, the primary operator's controls and the operator's CTC display unit.



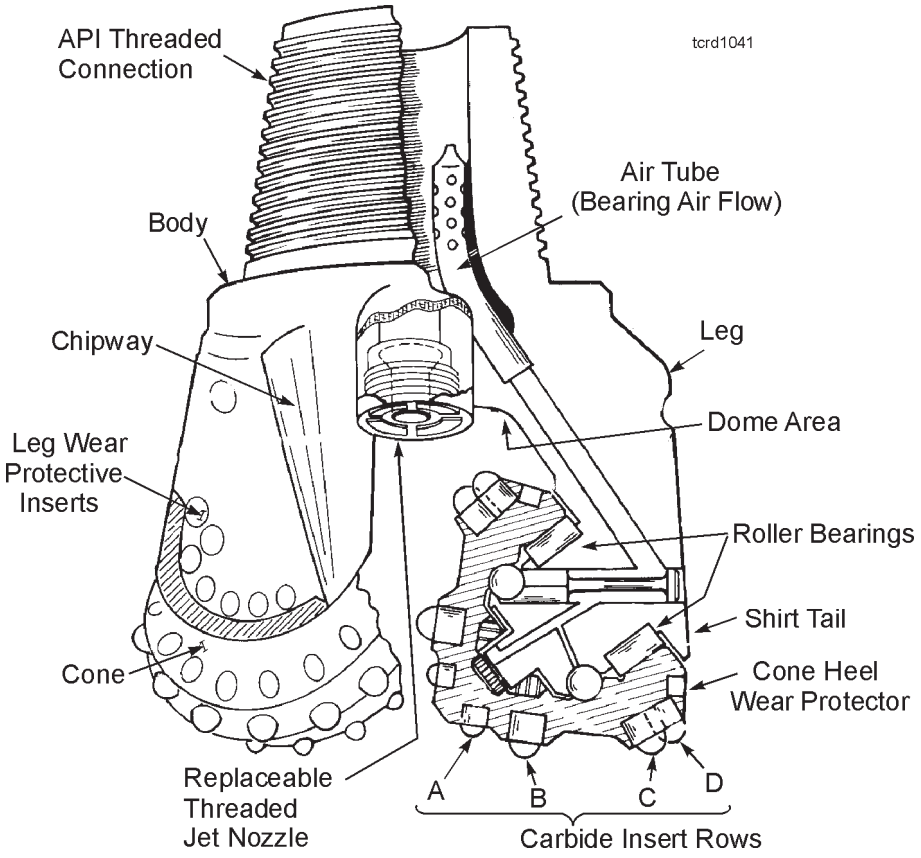
PIPE RETENTION DEVICE

The Pipe Retention Device is used as a safety feature that allows the pipe arm to load a pipe into the mast, but prevents the drill pipe from falling forward toward the machinery deck when the pipe arm is down. As the pipe arm is pushed toward the rear of the machine through the gates, the gates will swing toward the rear. Both gates will swing together with the use of a wire rope and pulley system between them. When the pipe is in place, the gates will swing shut with the help of the safety gate spring. Rubber bumpers will absorb the shock of the gates closing. The gates are trimmed to a set length to clear the drill pipe when closing. Please note that changes in pipe size will require adjustment to the gate length.



When selecting drill steel sizes it is advisable to ensure that sufficient air volume is available to bail at the minimum acceptable velocities. Remember, as the outside diameter of the drill steel is reduced by friction the annular area will be increased.

Having selected a type of drill bit according to expert advice, the size of cutting most likely to be produced can be determined. Measure the distance between the centers of the carbides (teeth) of the drill bit. This will determine the maximum size of cutting, or particle, that bit is capable of producing. Next, measure the depth that the carbide can penetrate the rock formation without affecting the cone matrix. This will determine the particle thickness. It is a good practice to ensure that the particle size does not exceed the radial clearance of the annular area.



Typical Tri-Cone Roller Drill Bit Components

Operating Mode Switch

This four-position switch is used to select one of three drill operating modes.

PROPEL - Enables all propel functions while disabling the winch, mast and all rotary and pulldown/hoist functions.

DRILL - Enables all drilling functions while disabling all propel functions.

MAST/WINCH - Enables all mast and winch functions while disabling all propel functions.

REMOTE - Enables all propel functions to be operated from the remote control unit and disables the cab operator controls.

Main Air Valve Switch

This two-position switch is used to control the butterfly valve in the air compressor discharge line. The operating mode switch must be in DRILL.

OPEN - Opens the butterfly valve.

CLOSE - Closes the butterfly valve which will cause the air compressor to run unloaded.

Pulldown/Hoist Rate Potentiometer

NOTE: Switching between functions can be done at any time. However, affect will not take place until the PULLDOWN/HOIST rate potentiometer is returned to the neutral position.

This potentiometer is used to control the speed and direction of the pulldown/rotary drive unit. The OPERATING MODE switch must be in the DRILL position and the Hoist Brake switch must be in the RELEASE position for this switch to function.

NOTE: The speed of operation increases as the potentiometer is rotated from OFF toward MAXIMUM in either direction. Maximum obtainable speed is determined by the position of the Pulldown/Hoist Speed Range switch.

TO HOIST: Rotate the knob clockwise from OFF toward MAXIMUM to raise the pulldown/rotary drive unit.

TO PULLDOWN: Rotate the knob counterclockwise from OFF toward MAXIMUM to lower the pulldown/rotary drive unit.

MACHINE OPERATION

This section includes information and guidelines which the operator should follow prior to starting the drill. The inspections listed should be made prior to, or during the normal 8 hour service routines as detailed in Sections 3 & 4 of the Maintenance Manual for this machine.

Before starting the drill, inspect it to ensure it is properly prepared to be put into operation. Failure to perform this inspection could result in unnecessary downtime, machine damage, and possible injury to personnel. For example, an undetected oil leak could result in a dry gear case, leading to excessive gear wear or destruction, seized bearings, or other mechanical breakage. A few minutes spent inspecting the machine often results in considerable savings in time and machine efficiency. This inspection should be performed before each shift.

CAUTION: Do not climb on the mast to perform inspection or maintenance procedures. A slip or fall can result in severe personal injury or death. Use a “cherry picker” or “man basket” when the mast is raised. Use scaffolding and ladders when the mast is lowered to gain access to mast components.

LEVELING

To level the drill proceed as follows:

DANGER: Machine tip-over hazard! Do not attempt to raise or level the machine on a grade which exceeds the allowable operating grades for leveling as shown on the "Allowable Operating Grades" chart posted in the operator's cab. Failure to heed this warning could result in serious personal injury or death if the machine tips over.

NOTE: Refer to the slope indication displayed on the LEVELING/PROPEL screen and abide by the above warning before attempting to level the drill.

1. Position the drill where the new hole is to be drilled.

2. Turn the OPERATING MODE switch to the DRILL position.

3. Verify that the leveling jack pads will rest on solid footing. If necessary, cut away or fill in the area where the pad will rest. Otherwise, reposition the drill to achieve solid footing.

NOTE: The maximum swivel angle for a jack pad relative to the spud is 25º.

4. Press the LEVELING JACKS rocker switches to the EXTEND position and lower the jacks until the pads are resting on the ground.

NOTE: When the FRONT rocker switch is pressed to raise or lower the drill, both front jacks will extend or retract simultaneously. However, when the jacks are not in contact with the ground, they may not extend or retract at the same rate. Continue to press the switch until both jacks are in contact with the ground or are fully retracted.

DANGER: Machine tip-over hazard! Always raise or level the machine by using the jacks on the downhill side or end of the drill, first. Failure to heed this warning could result in serious personal injury or death if the machine tips over.

5. Refer to the level indication displayed on the Leveling/Propel Screen and continue to press the LEVELING JACKS rocker switches to raise the drill until the crawler tracks are just off the ground. (It may be necessary to alternate pressing and releasing the switches to keep the machine relatively level during raising.)

6. Level the machine by alternately pressing the LEVELING JACKS rocker switches until the Leveling/Propel Screen shows that the drill is level within ± 0.2º. Use the rear leveling jack on the downhill side of the drill to adjust the machine side-to-side. Use jacks to remove weight from crawlers when possible.

7. When the drill is level, verify that the weight of the machine is off the crawlers. This will improve stability and reduce wear on the lower rollers.

PIPE CAROUSEL & HANDLING ARM OPERATION

1. With the engine running at high speed, turn the OPERATING MODE switch to the DRILL position.

2. Turn the PULLDOWN/HOIST SPEED RANGE switch to the PIPE JOINT position.

3. If there is no drill pipe in the pipe handling arm, turn the PIPE ARM CLAMP/GATE switch to the OPEN ALL position to open the pipe handling arm clamps and gates.

4. The pipe carousel can now be rotated one position to load a drill pipe into the pipe handling arm. There are two independent controls which may be used to index the carousel:

The AUTO INDEX PIPE CAROUSEL switch is a three position switch, with the spring centered position being neutral. When this switch is turned to the LOAD position and then released, the carousel will rotate in the direction to load a pipe into the handling arm, and will stop automatically when the pipe is centered over the handling arm clamps.

5. The drill pipe can be unloaded from the pipe handling arm in the same manner. First, ensure that the PIPE ARM CLAMP/GATE switch is at the OPEN ALL position and that the pipe clamp and both gates are open. To rotate the carousel in the unload direction, either turn the AUTO INDEX PIPE CAROUSEL Switch to the UNLOAD position and release it. Rotation of the carousel will stop automatically in the AUTO INDEX mode when the next empty slot in the carousel index plate is in-line with the handling arm hooks.

6. The carousel is interlocked with the handling arm so that the carousel will not rotate unless the handling arm is all the way down and resting on its supports. If the handling arm is down and has a drill pipe in it, the auto index pipe carousel will not rotate in the LOAD direction, but will rotate in the UNLOAD direction to allow removal of the drill pipe from the handling arm. If the handling arm is all the way down but does not have a drill pipe in it, the auto index pipe carousel will not rotate in the unload direction, but will rotate in the LOAD direction. Rotation of the auto index pipe carousel is always indexed one position at a time with an automatic stop at the next index position in both the LOAD and UNLOAD directions.

TOOL HANDLING

This section describes the procedures necessary to load, unload, handle, assemble and disassemble the drill tools. These procedures are as universally applicable as possible, but may not take into account every possible machine option or tool vendor's product. It is important to not only become familiar with these procedures, but with the machine and the particular tools being handled.

6. Lower the deck bushing onto the tool wrench using the auxiliary winch.

7. Use the rotary motors to unscrew the drill pipe.

8. Hoist the drill pipe about 2 to 3 feet above the stabilizer, while turning the rotary motors.

9. Use the auxiliary winch to remove the deck bushing.

10. Attach the lifting bell and hoist the stabilizer from the deck platform and place it on the ground.

ADDING ADDITIONAL DRILL PIPE

Installation of additional sections of drill pipe is necessary when the depth of the hole is to be greater than the total length of one section of pipe. Installation of additional sections of pipe is essentially the same procedure as installation of the first.

To add an additional section of drill pipe, proceed as follows:

1. The first part of the hole should be drilled as deep as possible with the first section of pipe. The hole should be drilled deep enough to place the joint between the rotary drive unit and the top of the first section of the pipe even with the top of the tool wrench. After completing this section of the hole, turn the main air stream off.

2. Raise the tool string until the slots in the top of the first section of pipe are aligned with the tool wrench. Clamp the tool wrench firmly around the drill pipe.

3. Quickly turn the ROTARY SPEED knob to the left (counterclockwise) to approximately one-half of full speed. The rotary coupling should turn, breaking the joint between the extender and the pipe. If the joint does not break, leave the tool wrench on the drill pipe and use the casing tong on the rotary coupling extender to break the joint.

4. Once the joint breaks, apply enough hoist power to raise the rotary/pulldown unit as the joint is unthreading. Do not apply enough power to lift the tool wrench and cause it to lose its grip on the pipe.

5. Raise the rotary head assembly to the pipe arm head limit. Simultaneously raise the pipe arm with the pipe to be installed.

6. Turn the PULLDOWN/HOIST SPEED RANGE switch to the PIPE JOINT position and the OPERATING MODE switch to the DRILL position.

DRILLING DIFFICULT FORMATIONS

The drilling procedure given in the early part of this section assumes that drilling takes place in consistent, consolidated rock formations. Unfortunately, not all drilling is in this type of formation. This topic will detail, in general, some typical drilling difficulties which you may encounter.

The two main causes for 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 normal 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 these types of formations is the same as for drilling in normal formation. The hole is collared, drilled, reamed, and cleaned using the standard operating procedures. However, monitoring of the machine is much more critical while drilling in difficult formations.

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

UNCONSOLIDATED MATERIALS

Drilling in unconsolidated materials may present two problems. The first, and most severe, is the vibration encountered if the penetration rate is too fast. Normally, as the bit rotates, the cones pass over the material and the teeth or inserts chip away at the material being drilled. However, because unconsolidated material has voids in it, when the bit passes over a void it only contacts part of the bottom of the hole. As each cone passes through the void, the tool string moves down, as the cone falls into the void, and then back up as it climbs out. This continual up and down motion results in shock loads being transmitted from the bit, through the tool string, to the machine.

To drill through an unconsolidated formation, it is necessary to reduce the load on the bit as it is passing over the voids. It is also helpful to isolate the shock loading to the tool string. This is accomplished by first reducing the pulldown speed. If reducing the pulldown speed does not reduce the vibration to the machine to an acceptable limit, it may even be necessary to hoist the bit above the void and then lower the bit a small amount at a time so as to chip away at the sides of the void a little at a time. Reduction of the rotary speed will also help reduce the vibration of the tool string. This is the last procedure that should be tried since if the pulldown speed is left high and the rotary speed diminished, the vibration will be just as severe, only at a different frequency.

NOTE: It may be necessary to regrind the cuttings to make them small enough to seal the leak or, if the drill is equipped with the water injection system, increase the water flow rate to help case the hole.

UNATTENDED LONG TERM STORAGE

Due to the additional amount of time the machine is to be stored without being attended to, extra measures must be taken to protect the machine.

To prepare the drill for unattended long term storage, proceed as follows:

1. Perform the short term storage procedures with the following exceptions:

   Prior to engine shutdown, check the crawler manufacturer's manual for any storage procedures which may apply. Perform any recommended procedures. If none are recommended, propel the drill onto wooden blocks, then coat each entire crawler belt with rust preventative oil.

2. Fully retract the leveling jacks. Use blocks to support the jacks in the retracted position.

3. Close and completely seal all cabinets.

4. Remove and store the auxiliary winch rope.

5. Remove the air compressor from the machine and store in an attended heated building. Seal all open connections to the compressor and machine.

6. Refer to the engine manufacturer's manual and perform recommended long term storage procedures for the engine and radiator.

7. Cover the hydraulic oil cooler and engine radiator.

8. Coat the mast racks and pulldown pinions with a rust preventative oil.

9. Close and completely seal the operator's cab.