



Technical Manual

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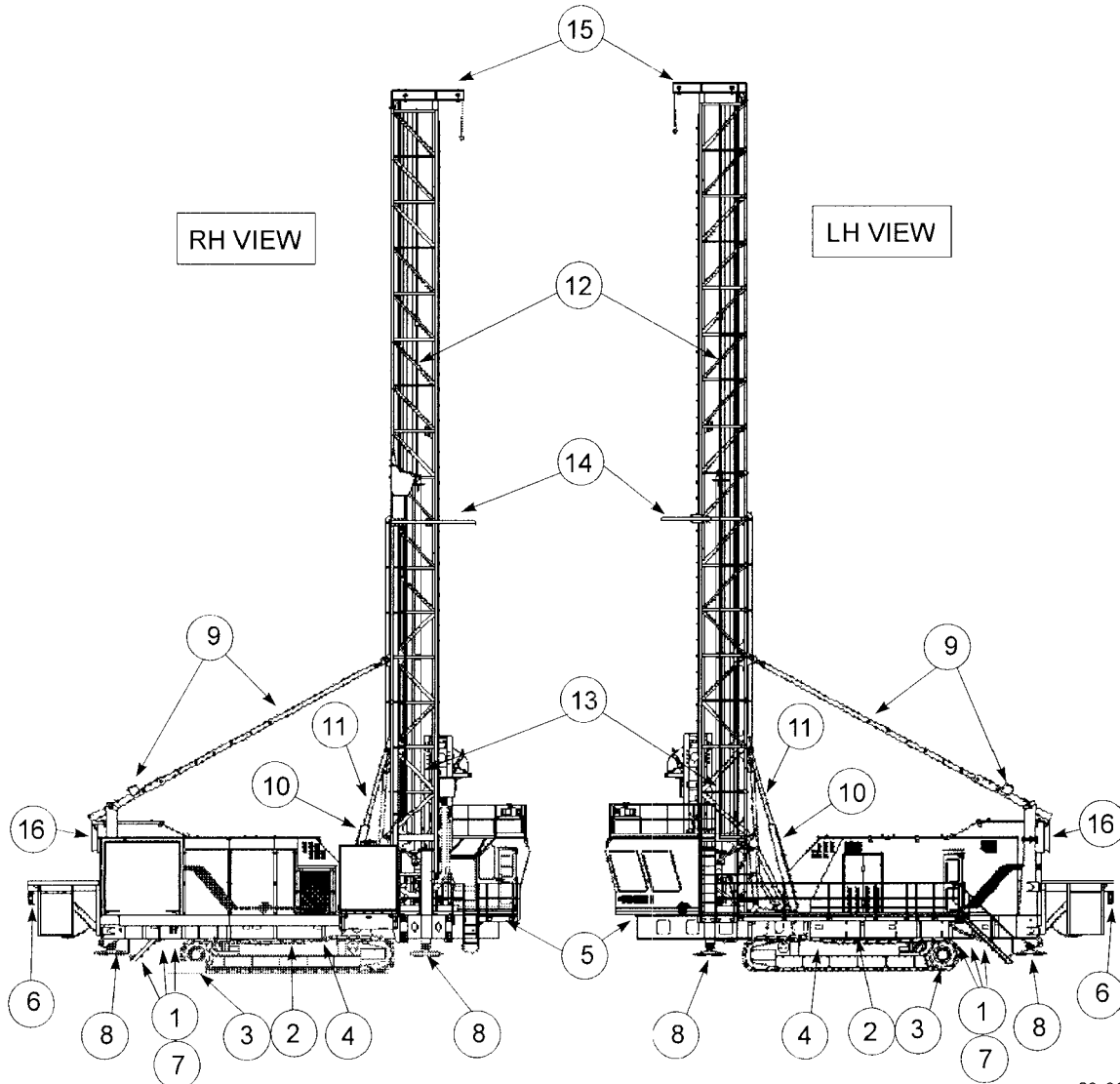
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PRESTART CHECKS

Before starting the drill, inspect it to ensure it is ready to be put into operation. Failure to make such a routine check could result in unnecessary downtime. For example, an undetected oil leak could result in a dry gear case, which would lead eventually to excessive gear wear or destruction, seized bearings, or other mechanical problems. 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.

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.



S2_01



When the operating mode selector switch is in the REMOTE position the ON and OFF push-buttons are not functional.

HOIST/PULLDOWN SPEED SELECTOR SWITCH

The hoist/pulldown speed selector switch (5) is located above the hoist/pulldown rheostat and is used to determine the speed range of the hoist/pulldown rheostat. The switch is a four-position switch with the following designations: PULLDOWN, HOIST HIGH, HOIST LOW, and PIPE RACK/JOINT.

In the PULLDOWN setting, which is used for normal drilling, full pulldown force is available but the speed range for both pulldown and hoisting is limited to about 25 FPM (7.62 MPM).

The HOIST HIGH and HOIST LOW settings are used for pipe raising at high speeds.

In the HOIST LOW position full hoisting and lowering force is allowed, but the speed is allowed to reach a higher level (typically about 65 FPM [19.8 MPM]).

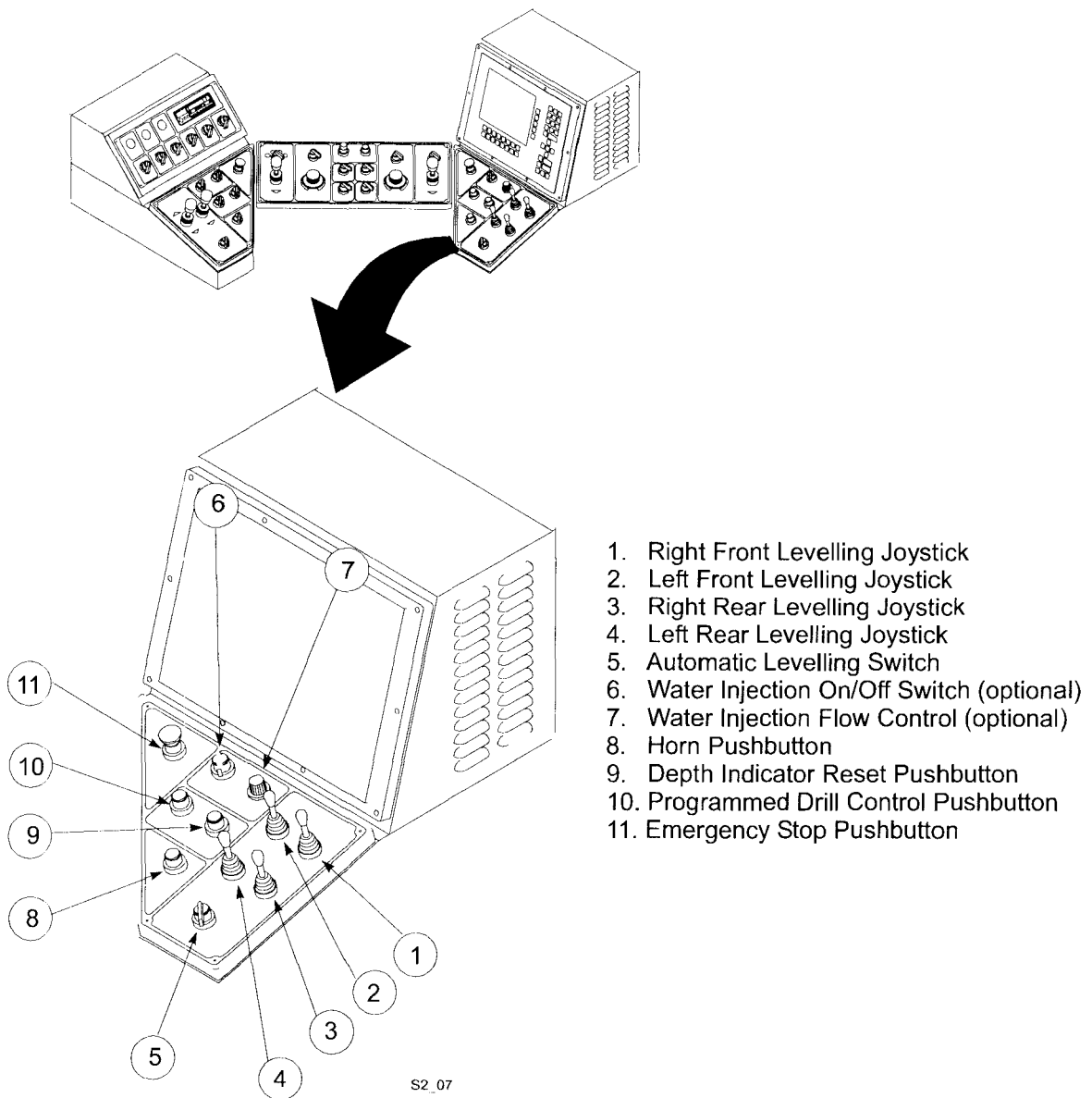
In the HOIST HIGH position maximum head speed capability is allowed for both hoisting and lowering. However, force capability in the lowering direction is limited to the weight of the rotary head/pipe combination. No additional downforce is allowed to the drive which reduces the chance of equipment damage during lowering operation.

As a result of obtaining a higher speed, the hoist force capability at full speed is not as large as is obtainable in the HOIST LOW position.

In the PIPE RACK/JOINT position, the hoisting and lowering force capabilities are the same as those when the switch is in the HOIST HIGH position. However, the speed limit is reduced to 25-35 FPM (7.62-10.67 MPM). This is the switch position for any pipe rack operation.

NOTE: PIPE RACK OPERATION ALSO REQUIRES THE ROTARY HEAD ASSEMBLY TO BE ABOVE THE PIPE RACKS BEFORE OPERATION IS ALLOWED.

LEVELING CONTROL PANEL



S2.07

LEVELLING CONTROL PANEL

The leveling portion of the panel consists of four two-directional joysticks, one for each leveling jack cylinder and an automatic leveling switch.

MANUAL LEVELING JOYSTICKS

The four two-directional joysticks (1, 2, 3, & 4) are used to manually raise or lower the leveling jacks. Moving a joystick forward will extend the corresponding jack cylinder and raise that corner of the machine. Pulling the joystick toward the operator will retract the corresponding leveling jack cylinder and lower that corner of the machine. These joysticks are not functional if the automatic leveling switch is being used.



START-UP

Start-up of the drill is not a difficult operation, but it is very important. Improper start-up could cause various safety and operating difficulties as well as damage to the machine. Following the step-by-step procedure listed below to start the machine will help reduce the possibility of accidental injury or machine damage.

MACHINE START UP

NOTE: THE MACHINE IS TO BE STARTED ONLY AFTER THE PRESTART INSPECTION AND LUBRICATION AS DETAILED EARLIER IN THIS SECTION, HAVE BEEN COMPLETED.

1. Go into the operator's cab and verify that all controls on the operator's console are in the off or neutral position. Be sure that the EMERGENCY STOP push-button is in the pulled-up position.

NOTE: ON SOME MACHINES THERE ARE TWO OR MORE EMERGENCY STOP PUSH-BUTTONS. BE SURE THESE PUSH-BUTTONS ARE IN THE PULLED-UP POSITION.

2. Go to the machinery house to the low voltage start cabinet. Turn on the main compressor breaker.
3. On the low voltage cabinet turn all the breakers to the ON position.
4. On the programmable controller cabinet verify that the lockout control push-button is in the RELEASED position. Turn the house pressurization fan switch to the desired operating position. Verify that the operator's display terminal power supply, PLC input and PLC output breakers are in the ON position,
5. Press the air compressor start push-button on the programmable controller cabinet to start the main compressor.

NOTE: IF THE AMBIENT TEMPERATURE IS BELOW 32°F (0°C), THE MACHINE WILL NORMALLY USE SPECIAL FLUIDS IN THE HYDRAULIC SYSTEM AND/OR HEATERS FOR THE SYSTEM.

When the machine is shutdown, temporarily or for an extended time, power should be left on the machine to maintain heater operation. If power is removed at shutdown, the machine fluids should be warmed to at least 32°F (0°C) before attempting to start the machine.



- d. Tighten 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.

NOTE: ANYTIME PRESSURE DROPS BELOW 800 PSI (5,520 KPA), BRAKES COULD DRAG RESULTING IN PREMATURE BRAKE FAILURE.

NOTE: DO NOT TOW AT SPEEDS GREATER THAN 1.1 MPH (1.8 KPH) EXCESSIVE PLANETARY GEARBOX HEATING CAN OCCUR.

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

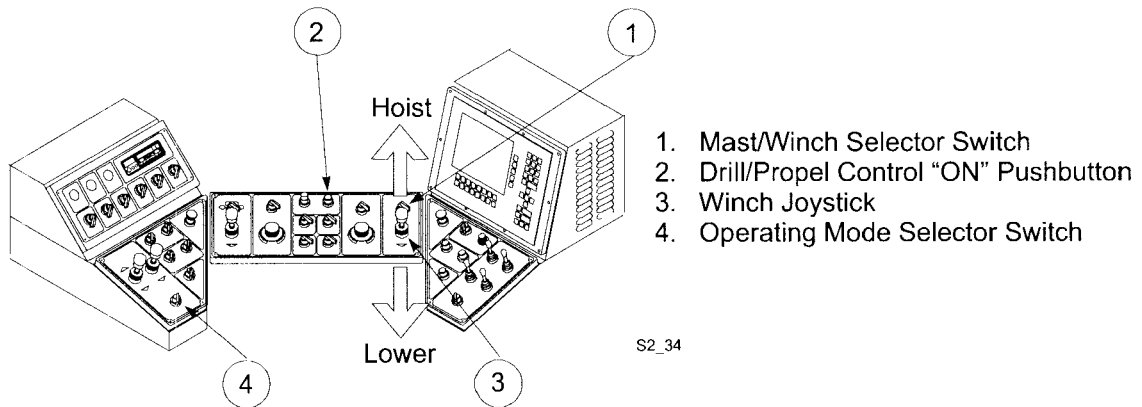
- When the hoist/pulldown operations are complete, set the hoist/pulldown speed rheostat to the "0" position and then turn the hoist brake switch to the SET position.



CAUTION: WHENEVER THE HOIST/PULLDOWN SPEED RHEOSTAT IS IN THE "0" POSITION, THE HOIST BRAKE SWITCH MUST BE IN THE SET POSITION TO PREVENT THE ROTARY/PULLDOWN UNIT FROM CREEPING DOWNWARD DUE TO THE WEIGHT OF THE UNIT.

AUXILIARY WINCH OPERATION

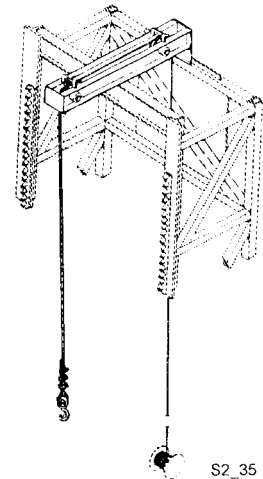
To operate the auxiliary winch proceed as follows:



S2_34

WINCH OPERATION CONTROLS

- Place the winch/mast control selector switch in the WINCH position.
- Place the operating mode selector switch in the DRILL position. The main air compressor must be energized.
- To hoist the auxiliary winch line, lift and move the mast/winch joystick, located on the main control panel, forward. To stop the line, return the joystick to the NEUTRAL position.
- To lower the winch line, lift and move the joystick rearward. To stop the line, return the joystick to the NEUTRAL position.



S2_35

7. When the drill pipe begins to turn with the rotary coupling, stop the rotary motion and check the joint between the coupling and the pipe. The shoulders on the pipe and coupling must be together. If there is clearance between the shoulders, it will be necessary to tighten the joint some more before the pipe is removed from the rack. If the shoulders of the pipe and coupling are contacting, the joint is made up.

**CAUTION:**

THE THREADS ON THE DRILL PIPE ARE TAPERED TO MAKE ASSEMBLY AND DISASSEMBLY OF THE PIPE EASIER. THE THREADS ARE DESIGNED TO DISENGAGE AFTER ONLY A FEW REVOLUTIONS OF THE PIPE. FAILURE TO HAVE THE PIPE SHOULDERS CONTACTING MAY RESULT IN THE PIPE JOINT UNCOUPLING AND THE PIPE FALLING FROM THE ROTARY/PULLDOWN UNIT.

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:**

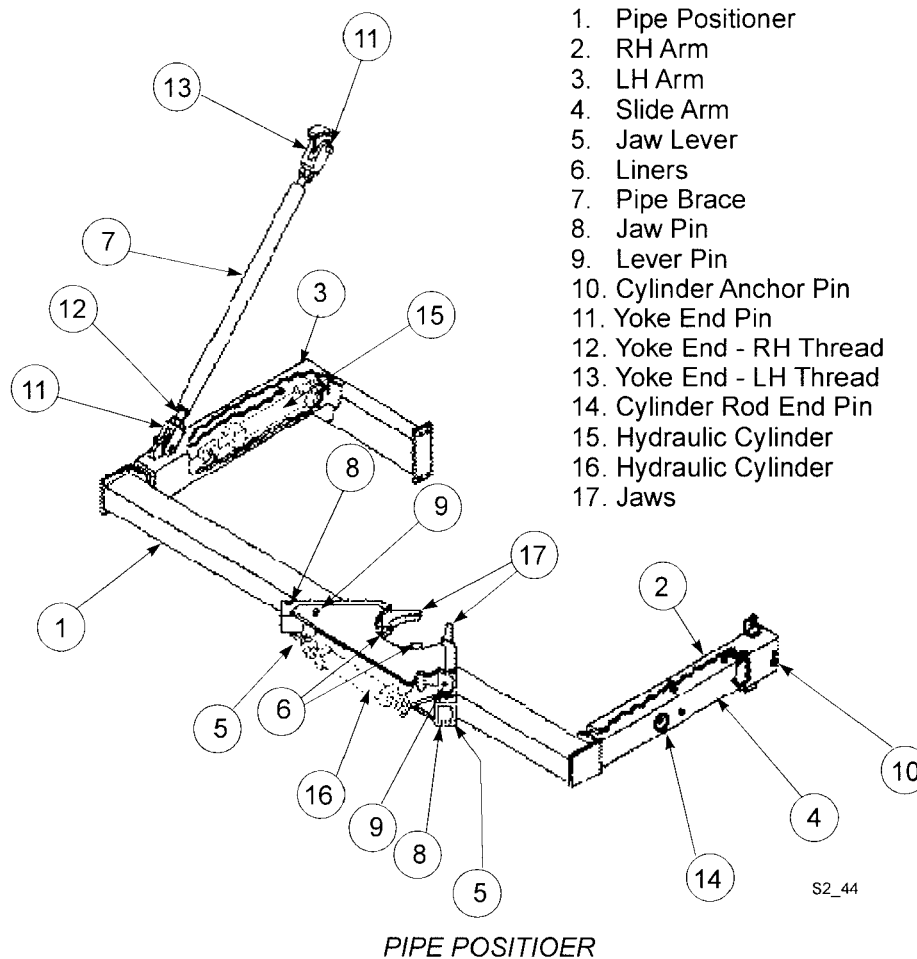
DO NOT LIFT THE DRILL PIPE. LIFT THE ROTARY/ PULLDOWN UNIT ONLY ENOUGH TO RELIEVE THE PRESSURE ON THE THREADS. LIFTING THE UNIT ENOUGH TO LIFT THE PIPE WILL NOT ONLY PUT PRESSURE ON THE OTHER SIDE OF THE THREADS, BUT MAY ALSO ALLOW THE PIPE RACK UPPER GATE TO OPEN. SHOULD THE JOINT UNCOUPLE AT THIS POINT, 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 forward to the STORED position.

All tool handling procedures are carried out the same way either in angle drilling or in standard vertical drilling. The only addition to the procedures is the use of the pipe positioner to hold the drill pipe to be threaded together in position and a mast A-frame with adjustable front legs. It also includes an adjustable pipe seal which can be moved to align with the drill pipe.



During angle drilling the deck remains horizontal providing a horizontal surface to work from. The drill pipe, however, is laying at the angle of the mast. In order to make a joint at the drilling deck, such as when adding the stabilizer, bit or drill pipe or when removing these components, it is necessary to hold the drill pipe in position so as to line up with the drill pipe or component being held on the drill deck. This is the function of the pipe positioner.

The pipe positioner is moved into position by hydraulic cylinders. The pipe positioner jaws are opened by a single hydraulic cylinder.

NOTE: DO NOT OPERATE THE ROTARY MACHINERY EXCEPT AT LOW SPEEDS TO MAKE AND BREAK JOINTS WHILE THE JAWS ARE CLOSED AROUND THE PIPE. OPERATING THE ROTARY MACHINERY AT HIGH SPEEDS OR DRILLING WHILE THE PIPE POSITIONER JAWS ARE CLOSED AROUND THE PIPE WILL DAMAGE THE JAWS AND POSITIONER STRUCTURES.



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.

UNCONSOLIDATED MATERIALS

Drilling unconsolidated materials may present two problems. The first, and most severe, is the vibration encountered if the penetration rate is too fast. As the bit rotates the cones pass over the material and the teeth or inserts chip away at the material being drilled. Unconsolidated material, however, has voids in it. When the bit passes over a void in the material it only contacts part of the bottom of the hole. As each roller passes through the void, the tool string moves down, as the roller falls into the void, and then back up as the roller 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 pull-down speed. If reducing the pull-down 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 pull-down speed is left high and the rotary speed diminished, the vibration will be just as severe, only at a different frequency.

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