Technical Manual

MAST COMPONENTS:

STANDARD MAST FOR DRILL PIPE AND ONE RACK 60'-0" (18.29m)
Computer Analyzed, tubular lattice construction with back braces.
RAISING and LOWERING Two-9" (220mm) diameter hydraulic cylinders
ANGLE HOLE DRILLING (1)to 25° off-center in 5° increments

HOIST/PULLDOWN:

Chainless rack and pinion driven by head-mounted excavator grade DC motor.

BIT LOADING UP TO:	140,000 lbs	(63,500 kg)
FEED RATE UP TO:	25 fpm	(7.62m/min)
HOIST RATE UP TO:	100 fpm	(30.48m/min)
LOWERING RATE UP TO:	100 fpm	(30.48m/min)
AUXILIARY WINCH STANDARD CAPACITY:	12,000 lbs	(5,433 kg)

PIPE RACKS:

SINGLE RACK	STANDARD	
1 PIPE RACK	10.75" TO 17.5"	(273-445mm)
2 PIPE RACKS	10.75" TO 17.5"	(273-445mm)
4 PIPE RACKS	to 10.75"	(273mm)

ROTARY DRIVE:

CONTINUOUS OUTPUT	205 hp (153kw)
MAXIMUM BIT SPEED	120 rpm

AIR COMPRESSOR:

A-C Compressor Corporation KS46AC Screw Type
4,600 CFM (130.2m³/min) free air @ 80 psi (552 kPa) (2)
or
A-C Compressor Corporation KS40AC Screw Type
3,600 CFM (101.9m³/min) free air @ 70 psi (483 kPa) (2)

Safety must always be paramount!

Consult your supervisor when safety is in doubt.

SAFETY PRECAUTIONS

Safe operation of a rotary blast hole drill promotes personal safety and minimizes delays and costly damage to equipment. Carefully study and follow all recommended procedures in this manual. Safety guidelines are intended to help prevent accidents from occurring and are provided in the interest of all mine personnel. Overall safety depends upon a good sense of judgment and alertness on the part of the entire mining crew.

The following is a list of some important safety rules relating to prestart and operation of the 59R drill. The safety instructions given in this manual cover normal daily operations of the machine. Additional precautions may be necessary to cover unusual circumstances. Be constantly alert for any potentially dangerous conditions and take action as necessary to correct the conditions immediately.

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.

CAUTION: Death or serious injury could result should any part of the drill come within the minimum distance specified of an energized power line.

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.

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.

19. Inspect the tool string for excessive wear, dirt accumulation, bent pipe and secure joints. The bit cones and bearing should be in good condition. Manually turn the cones to make sure they turn freely.

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

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

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

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

24. Check the hoist brake for proper operation.

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

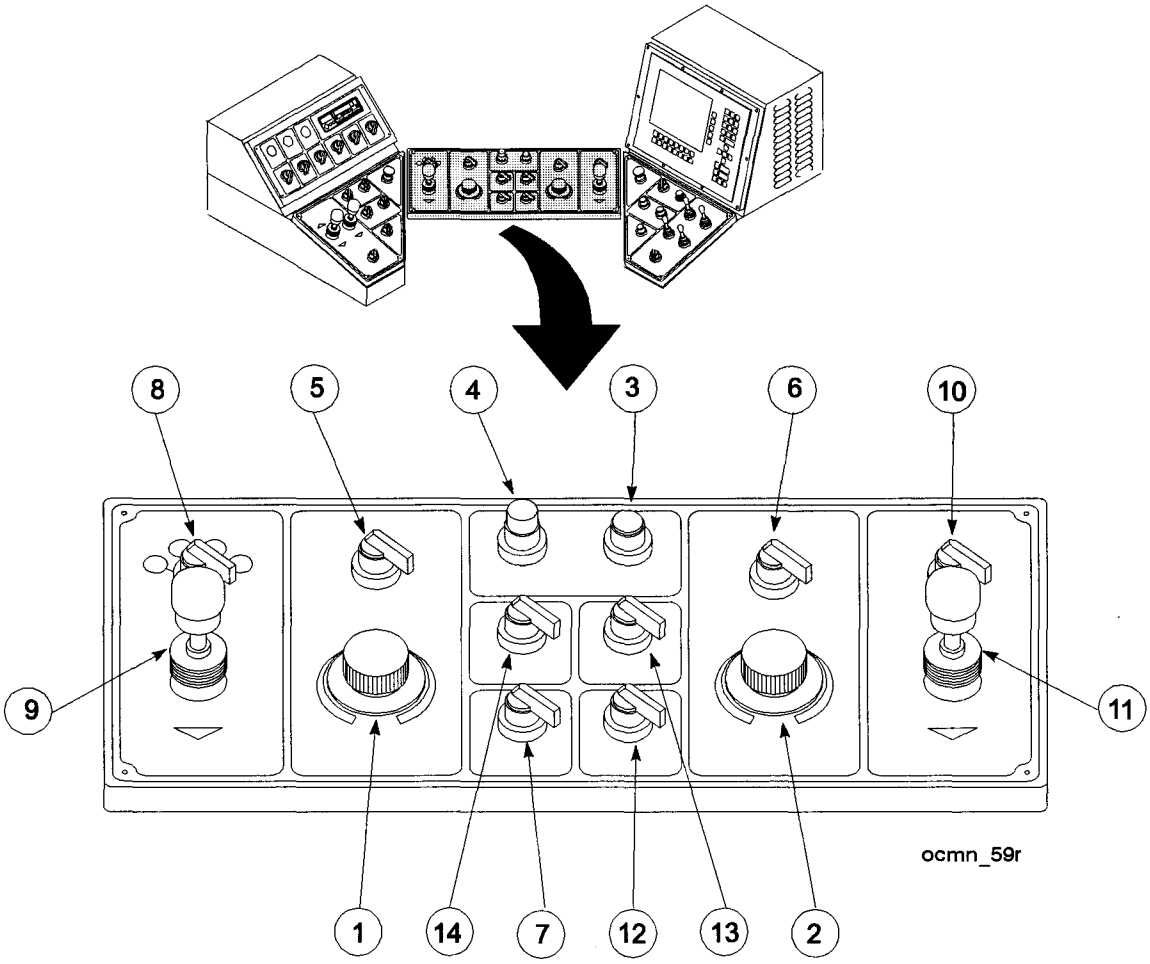
26. If the machine is equipped with a fire suppression system, perform any applicable checks or inspection as described in the fire suppression system owner's manual.

PRESTART LUBRICATION

Lubrication of the 59R blasthole drill is an extremely important job. Most drills come equipped with automatic lubrication systems that lubricate most of the necessary points at regular intervals. These systems, although automatic, are not foolproof. Broken lines, dirty lubricant, faulty feeders, and a whole range of other problems can cause wearing parts to loose lubrication. For this reason, it is important that all lubrication points be inspected every shift to verify that they are receiving lubrication. Also, there are several points for lubrication that either need lubrication very infrequently, or are not possible to pipe into the automatic system. These points will need lubrication applied manually.

The lube charts in Appendix 3 gives the location and frequency of lubrication.

MAIN CONTROL PANEL



1. Hoist Pulldown Rheostat
2. Rotary Speed Rheostat
3. Drill/Propel "ON" Pushbutton
4. Drill/Propel "OFF" Pushbutton
5. Hoist/Pulldown Speed Selector Switch
6. Rotary Speed Selector Switch
7. Hoist Brake Switch
8. Pipe Rack Selector Switch
9. Pipe Rack Joystick/LH Propel
10. Winch/Mast Selector Switch
11. Mast/Winck Joystick/RH Propel
12. Tool Wrench Switch
13. Dust Curtain Switch
14. Bit View Hatch Switch

Main Control Panel

TOOL WRENCH SWITCH

The tool wrench switch (12) is a three-position spring return switch. Turning the switch to the EXTEND position will cause the tool wrench to extend to clamp the drill pipe. Turning the switch to the RETRACT position will retract the wrench, releasing the drill pipe. This switch is functional whenever the hydraulic pumps are running.

DUST CURTAIN SWITCH

The dust curtain switch (13) is a three-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.

In the AUTO position, the curtains are raised automatically when the operating mode selector switch on the propel control panel is in the PRIMARY PROPEL, SECONDARY PROPEL, or REMOTE PROPEL position. The curtains are not lowered automatically, but must be lowered by moving the switch to the LOWER position.

BIT VIEW HATCH SWITCH

This is a two-position switch (14) that is used to move the hatch for viewing the drill bit on the ground. Moving the switch to the CLOSE position will close the hatch. Turning the switch to the OPEN position will open the hatch.

MAST LOCK SWITCH

The mast lock switch (6) is a three-position spring-return switch. Turning the switch to the LOCK position will extend the mast lock cylinder. Turning the switch to the UNLOCK position will retract the cylinder. Before this switch can become operable the hydraulic pumps must be running and the mast/winch selector switch must be in the MAST position. For the switch to be functional in the UNLOCK position, the rotary head assembly must be at the lower limit point. On machines with the angle hole drilling feature, the A-frame locking pins must also be in place before this switch can become operable.

BOARDING STAIRS SWITCH

The boarding stairs switch (7) is a two-position switch. A like switch is located at the stairs. Depending upon the position of the stairs, the switch must be moved from its present position to the opposite position for the stairs to change position.

PEDESTAL HEATER SWITCH

The pedestal heater switch (8) is a two-position switch used to turn the heater ON or OFF.

FIRE SUPPRESSION SYSTEM INDICATORS

The fire suppression system indicators (9) show the status of the fire suppression system.

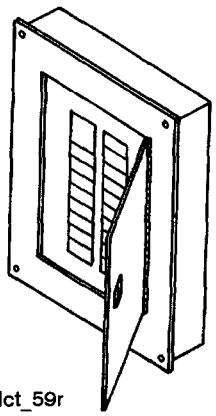
RADIO

The radio (10) is standard equipment.

MACHINERY HOUSE CONTROLS

NOTE: The controls shown on the following illustrations are typical of the controls on a machine. Because of the variations of controls that can be supplied for customers needs, be sure to become acquainted with the controls on the cabinets of your machine. All controls will be identified with nameplates.

LIGHTING LOAD CENTER



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The lighting load center is located on the right side of the front wall of the machinery house.

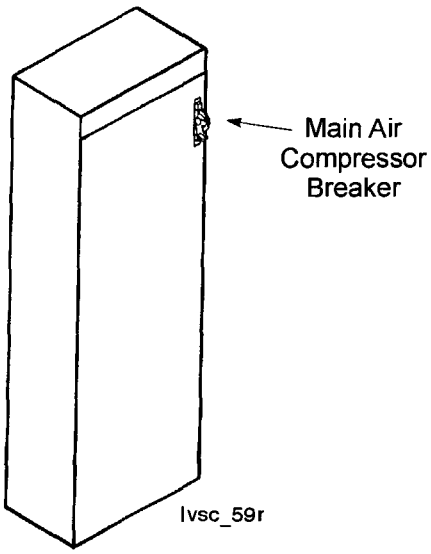
The lighting load center contains the breakers to control the interior and exterior lights and various auxiliary functions.

Each breaker is labeled as to its particular function on any particular machine.

The controls are three-position lever operated circuit breakers. Moving the lever in one direction (ON) will close the circuit, while moving it in the opposite direction (OFF) will open the circuit. The center position is the tripped position. The breaker may be reset by moving the lever to the OFF position and then back to the ON position.

CONTROLS ON THE LOW VOLTAGE START CABINET

The low voltage start cabinet contains the breaker for the main compressor. Turning the breaker to the ON position will activate the compressor circuits, allowing the compressor to be started.



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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 (see APPENDIX 5).

CAUTION: Do not attempt to maneuver or steer the machine on grades which exceed the allowable maneuvering slopes without consulting the special propel LIMITATIONS CHARTS AT THE END OF THIS 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: The drill should only be propelled 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.

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.

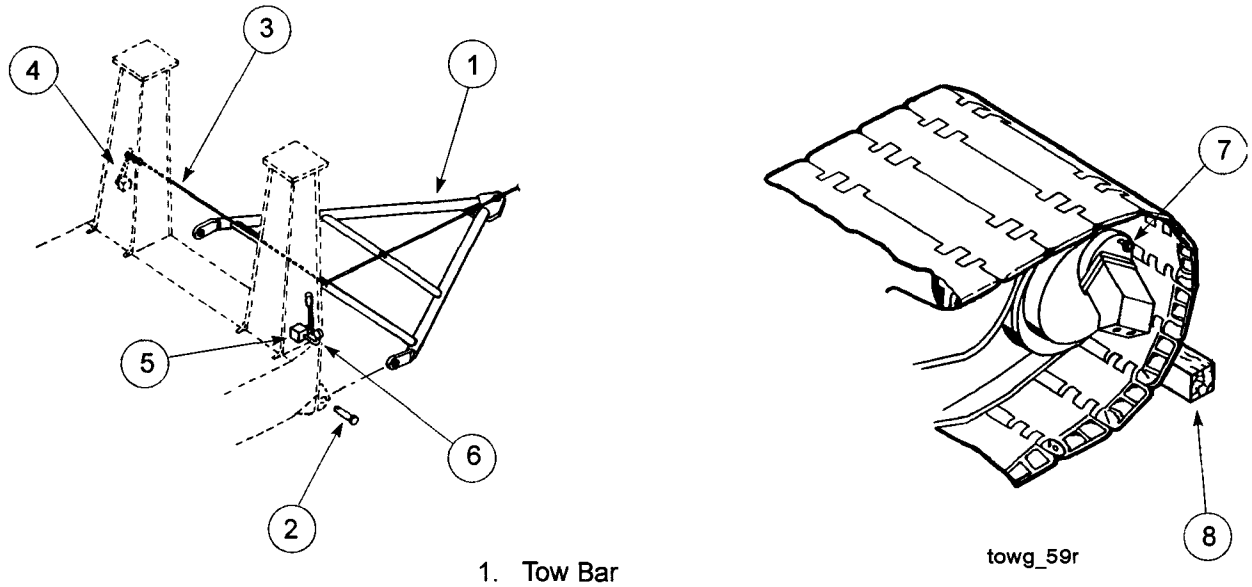
The 59R is propelled using the controls on the operator's console in the operator's cab or radio controlled from the remote propel station outside the machine.

TOWING PROCEDURE

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

1. Secure the machine by blocking crawlers.

2. Secure the tow bar to the towing vehicle.



1. Tow Bar
2. Tow Bar Pin
3. Lanyard
4. Safety Valve
5. Hand Pump
6. Hydraulic Pressure Gauge
7. Gearbox Disengaging Knob
8. Blocking

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

4. Disconnect the drive tumbler gearbox from the propel motor as follows:

   a. Ensure that the propel pump controls are in neutral position

   b. Loosen shifter lever lock screw

   c. Pull out shifter lever to disengage clutch

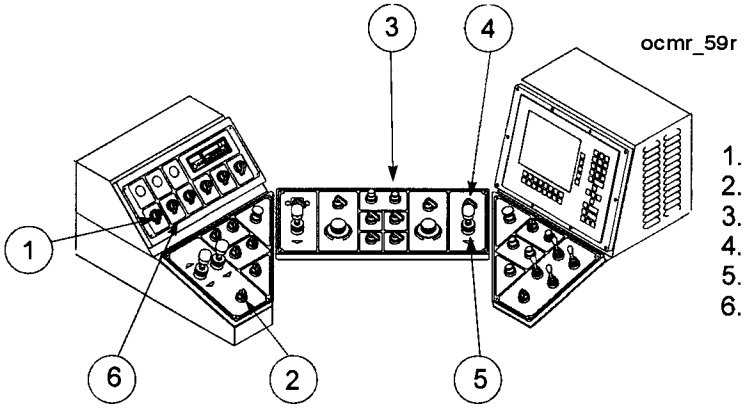
   d. Tighten shifter lever lock screw

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 winch/mast selector switch to the MAST position. Slowly raise the mast by lifting and then slowly pushing the mast/winch joystick, located on the main control panel, 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.

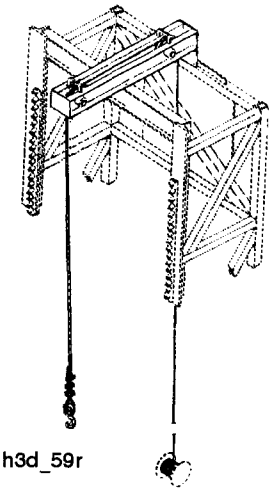
CAUTION: The mast joystick should be moved away from and returned to the neutral position very slowly. Sudden starts and stops can be damaging to the mast and hydraulic system. Be extremely cautious as the mast approaches 70 degrees as once the mast goes over center only a very slight movement of the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



1. Mast Lock Switch
2. Operating Mode Selector Switch
3. Drill/Propel "ON" Pushbutton
4. Winch/Mast Selector Switch
5. Mast Joystick
6. Mast Brace Lock Switch

Controls for Raising or Lowering the Mast

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 raised. Have a helper watch from a safe position on the left side of the machine as the mast is going up.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3. 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.

4. To lower the winch line, lift and move the joystick rearward. To stop the line, return the joystick to the NEUTRAL position.

PIPE RACK OPERATION

The machine can be equipped with 1 to 4 pipe racks and depending upon the number of pipe racks the pipe rack configuration and operation will be different.

- On a machines with one pipe rack, the rack will be on a swing out arm and will be in #1 position .

- On a machine with two pipe racks, the racks will be on swing out arms and will be in #1 and #4 positions.

- On a machine with three pipe racks, two pipe racks will be located on a carousel that swings out and then is rotated. This carousel houses pipe racks in #1 and #2 positions as shown. The third pipe rack is a swing out rack that will be in #4 position.

- On a machine with four pipe racks, there are two swing out carousels with two racks in each carousel. The carousels rotate to make each rack available for use. The left carousel houses racks #1 and #2 and the right carousel racks #3 and #4.

3. Position the pipe to be installed in such a position so as to be accessible to the crane. Normal placement of the drill pipe is on the left side of the machine, laying at right angles to the machine. This allows the crane to lift the pipe and swing without excessive boom hoisting and lowering. The pipe may be stored on suitable blocking on the ground, or on a truck or trailer.

CAUTION: Make sure the drill pipe is secured against unwanted or unexpected movement. Failure to secure the pipe properly may result in the pipe shifting and causing death or serious injury to personnel in the area.

4. The upper gate is open when the pipe rack is empty. This function is controlled by a limit switch in the lower pocket of the pipe rack.

5. Using suitable rigging, attach the crane to the drill pipe. The pipe should be rigged so that it will remain horizontal while being lifted. Attach suitable tag lines to the pipe. Remove the thread protectors and clean and lubricate the threads and shoulders on each end of the pipe. Install an approved lifting bell to the pin (upper) end of the pipe. Lift the pipe into position over the mast.

6. Using a tag line guide the pipe into the desired pipe rack. Place suitable blocking beneath the pipe to allow the sling to be removed from the pipe.

CAUTION: Block the pipe securely to prevent it from moving unexpectedly.

7. Remove the slings from the pipe. Attach a sling to the lifting bell on the pin end of the pipe and lift the pipe sufficiently to remove the blocking.

8. Slide the pipe down the pipe rack until it rests on the bottom of the pocket. Lay the pipe in the pipe rack and remove the sling and lifting bell.

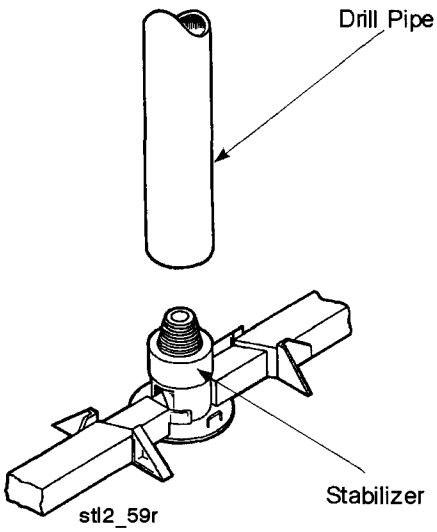
9. When the pipe rest in the bottom of the pocket it will trigger the limit switch and close the upper gate.

10. Repeat the procedure for additional lengths of pipe.

11. Unloading the pipe is the reverse of the procedure used for loading the pipe.

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. Depress the drill/propel control OFF push-button.



Stabilizer Installation

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.

13. When the stabilizer begins to turn with the drill pipe, check the joint between the stabilizer and the pipe. The shoulders on the pipe and stabilizer must be together. If there is clearance between the shoulders, it will be necessary to tighten the joint some more before the stabilizer is released. If the shoulders of the pipe and stabilizer are contacting, the joint is made up.

Installation of the drill bit is the last step in preparing the tool string.

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 the second and third sections of pipe is essentially the same procedure as installation of the first. The rotary/pulldown unit is raised above the pipe racks, a pipe rack with pipe moved over the hole, the rotary coupling threaded to the pipe, and the pipe removed from the rack and the rack stored.

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.

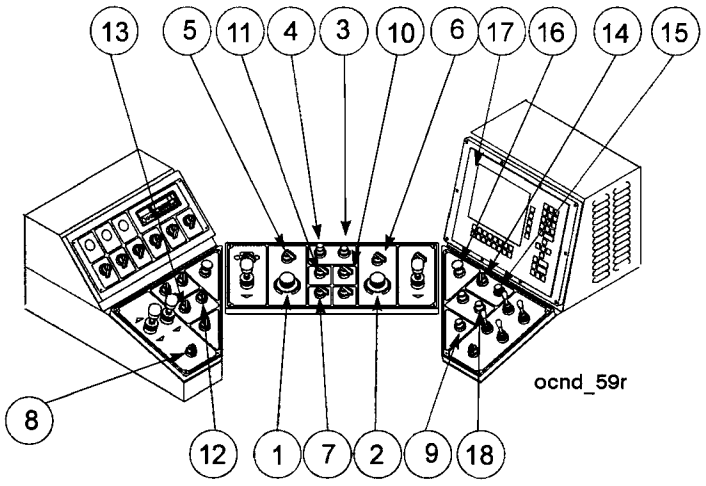
3. Quickly turn the rotary rheostat to the left (counterclockwise) to approximately one-half of full speed. The rotary coupling should turn, breaking the joint between the pipe and the coupling.

NOTE: If the joint does not break immediately, return the rotary rheostat to the zero position to reduce the chance of damaging the motor by stalling it.

4. If the joint does not break, it will be necessary to index the slots on the drill pipe so as to allow the rotary drive unit to build up speed before stopping the drill pipe. This is done by rotating the drill pipe in the forward direction until the slots in the pipe are almost aligned with the tool wrenches. This allows the drill pipe to rotate almost one-half turn before being stopped by the tool wrenches. The spring loaded inserts in the tool wrench allow the pipe to rotate while being clamped by the wrench.

After indexing the pipe to allow the one-half turn rotation, repeat step 3 above to break the joint. Repeat this procedure as many times as is necessary to break the joint.

5. When 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. Once the joint is completely disassembled, raise the rotary/pulldown unit to a position to make the coupling accessible from the drill deck. Set the hoist brake, depress the drill/propel control OFF push-button to prevent operation. Clean and lubricate the threads and shoulder of the rotary coupling. Use an approved drill thread compound on the threads and shoulder. After cleaning and lubricating the coupling, raise the rotary drive unit to a position above the pipe racks so as not to be struck by the pipe or rack as the rack swings into position over the guide bushing.



1. Hoist/Pulldown Rheostat
2. Rotary Speed Rheostat
3. Drill/Propel Control "ON" Pushbutton
4. Drill/Propel Control "OFF" Pushbutton
5. Hoist/Pulldown Speed Selector Switch
6. Rotary Speed Selector Switch
7. Hoist Brake Switch
8. Operating Mode Selector Switch
9. Signal Horn
10. Dust Curtain Switch
11. Bit Viewing Hatch Switch
12. Compressor "STOP" Pushbutton
13. Compressor Vent/Drill Switch
14. Water Injection "ON/OFF" Switch
15. Water Injection Flow Control
16. Emergency "STOP" Pushbutton
17. Panelview Monitor
18. Depth Indicator Reset Pushbutton

Controls for Normal Drilling

During the actual drilling the operator's display terminal should be turned on and the operator display screen shown on the monitor. All of the drilling parameters noted in the following paragraphs will appear on the operator's display screen.

NOTE: The bar graphs on the operator's screen on the operator display terminal shows the condition of each of each functions. If a function operates beyond its normal operating range, especially for rotary current and hoist/pulldown force, the bar graph color will change from green to yellow or red when the graph valve raises into that particular range. For details, refer to the Operator Display Manual.

STARTING THE HOLE (COLLARING)

Since the first few feet of a hole are usually in unconsolidated material, the procedure for drilling through this material will be different than for the remainder of the hole. This procedure is commonly referred to as collaring the hole.

To begin, or collar the hole, proceed as follows:

1. Verify that the tool wrench and breakout wrench are retracted fully. Clear the drill deck of personnel and material which is not necessary for the drilling procedure (i.e. oil drums, tools, spare bits, etc.).

2. Place the operating mode selector switch in the DRILL position. Place the hoist/pulldown speed selector switch in the PULLDOWN position. Depress the drill/propel control ON push-button. Release the hoist brake and allow the tool string to lower so that the guide bushing is firmly seated in the hole in the drill deck. Make sure that the slots in the bushing align with the

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 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.

Unconsolidated material presents another problem due to the fact that the voids in the material may allow the bailing air to escape through the sides of the hole, rather than passing along the drill pipe and exiting through the top of the hole. This loss of air reduces the volume of air available to bail the hole, causing the cuttings to fall to the bottom of the hole and be reground by the bit. This further reduces the penetration rate since these cuttings must be ground up by the bit and bailed out of the hole or they will plug the hole. Unconsolidated material may also cause the hole to cave in. This creates problems due to the sudden addition of material into the hole and the resultant loss of bailing velocity due to the increased diameter of the hole.

If unconsolidated material is causing the loss of bailing air volume or caving of the hole it is necessary to continually clean the hole as the recycled cuttings or the caved material will plug the hole. Closely monitor both the bailing air pressure and the flow of cuttings from the hole. If the air is being lost the air pressure will remain constant but the flow of cuttings will stop or drastically decrease while penetration does not decrease. Continue drilling for a few feet to try and get past the leak. If the bailing air pressure starts to rise, the hole is plugging. Immediately hoist the tool string until the pressure drops and allow the drill string to rotate for a few moments to clear itself. Then lower the tool string to the bottom of the hole and clean it out. It may be necessary to regrind the cuttings to

7. Verify on the operator's display terminal that no PDC faults exist. If a fault exits, it must be cleared before the PDC control can be activated.

8. With the operator's display screen shown in the operator's display terminal, press the depth indicator reset push-button to reset the hole depth and bit depth indicators to zero.

9. Place hoist brake control in the RELEASE position.

10. On the operator's display terminal with operator's display showing, depress keypad button F5 to turn on P.D.C. The readout above the F5 key will then read "PDC on."

After the above start-up procedure has been initiated the automatic controls will take over the actual drilling of the hole. Water injection (if so equipped) will be shut off at preset depth. When the total depth of the hole is reached, as preset, the tool string will be automatically hoisted and when the bit approaches the top of the hole, the control will stop the bit, shut off the air and set the hoist brake.

If problems arise in the P.D.C. functions, the system will have to be corrected by a qualified electrician. In most cases, if a malfunction occurs in the automated system, the automated system can be turned off and the drilling completed manually.

PREPARING TO MOVE

Once the hole has been completed and the tool string removed from the hole it is necessary to move the drill to the next hole location to prepare to drill the next hole. Preparing to move the drill consists of proper storage of the tool string, lowering the machine to the ground, and inspection of the machine and travel route prior to propelling.

To prepare the drill to move, proceed as follows:

1. Upon completion of the current hole, hoist the tool string from the hole. If using multiple pipe sections, remove and store all pipe necessary to remove the entire tool string from the hole. Turn off the dust control system and raise the dust curtains.

2. Clamp the stabilizer with the tool wrench to prevent movement of the tool string during propel.

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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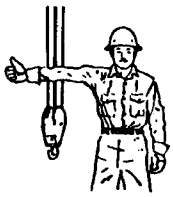
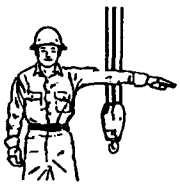
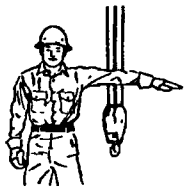


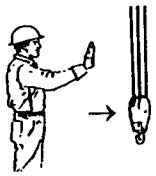
RAISE BOOM Extend arm fully with fingers closed and thumb pointing upward.



STOP Extend arm fully with fingers extended and palm facing down.



EMERGENCY STOP With arm fully extended, fingers fully extended and palm facing down, move arm rapidly along a horizontal plane.



TRAVEL With arm extended forward, hand open and raised at wrist, make a pushing motion in the desired direction of movement.

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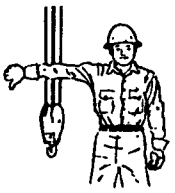
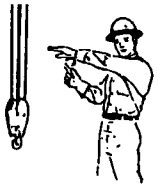
DOG EVERYTHING Clasp hands together in front of body.

TRAVEL (both tracks) With both fists clenched in front of body, make a circular motion with the desired direction of motion (forward or reverse) duplicated with fists.



LOWER BOOM Extend arm fully with fingers closed and thumb pointing down.



MOVE SLOWLY While giving any motion signal, hold other hand motionless in front of desired signal hand. (Hoist slowly is example provided)

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