

DRILLING with the Village Drill

Dr. MARK KING



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Drilling



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DRILLING – THE DRILLING PROCESS

- Staff the drill with four workers as shown. Each worker occupies one of four designated positions – three to four on the wheel and one at the winch.
- (There may be additional workers manning the pump or clearing the basins/trenches as well).

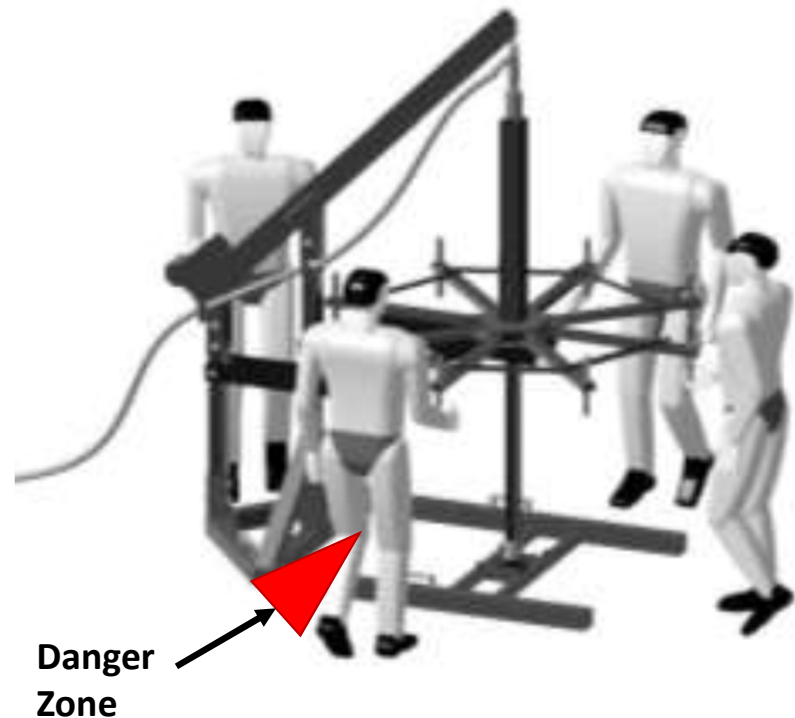


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DRILLING – THE DRILLING PROCESS

- **Do not operate wheel in danger zone**, a hand or arm could get pinched. Stand to the right of where handle passes through Z brace.
- To maintain sustainability, rotate the workers through the positions every bar or 20 minutes, giving the wheel workers a break while they man the winch.



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DRILLING – THE DRILLING PROCESS



- Run the pump to ensure that the water/slurry comes out the bottom of the drill bit.
- Fix any leaks in the hose connections.
- *Note: Always have the pump running BEFORE beginning to spin the wheel to drill.*

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DRILLING – THE DRILLING PROCESS

- Spin the Wheel **CLOCKWISE** at a comfortable rate, such as 30 RPM (or one revolution every two seconds).
- For rhythm, it may help to watch one peg as it goes around and always try to grab and push the same peg.
- Ensure safety by keeping hands and arms out of the path of the spokes.



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DRILLING – THE DRILLING PROCESS

- Turning the Winch handle COUNTER-CLOCKWISE, lower the drill string
- The rate of lowering should allow the wheel to continue to spin freely from the inertia in the spokes, while still “biting” into new ground at the bottom of the hole
- Controlling the lowering of the pipe is the key to efficient drilling.



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DRILLING – THE DRILLING PROCESS

- If the wheel stops immediately after each time the workers push it, pull up on the pipe (turning the Winch CLOCKWISE to hear the clicking noise) until it spins freely again.



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DRILLING – THE DRILLING PROCESS

- If the rate is too fast, the drill bit will become buried in the bottom of the hole and become difficult to turn.
- If lowered at a proper rate, the drill bit will only ever be in contact with the top layer of soil, easily scraping it off to be flushed to the surface by the pump / drilling mud.

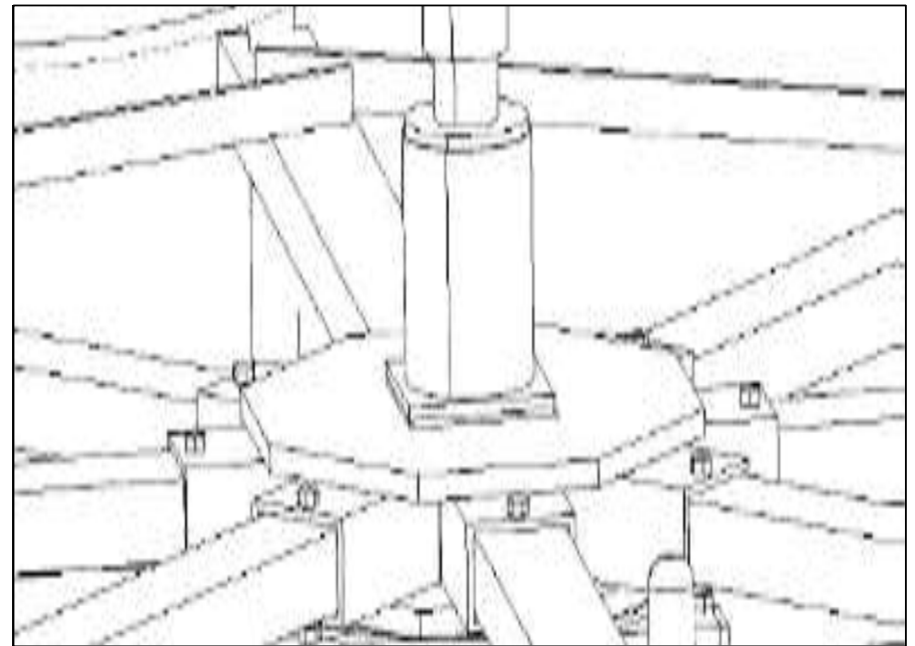


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DRILLING – THE DRILLING PROCESS

- Continue drilling until the top of the kelly bar is flush with the top of the wheel hub as shown.
- In soft soil, this should take about 2-5 minutes.

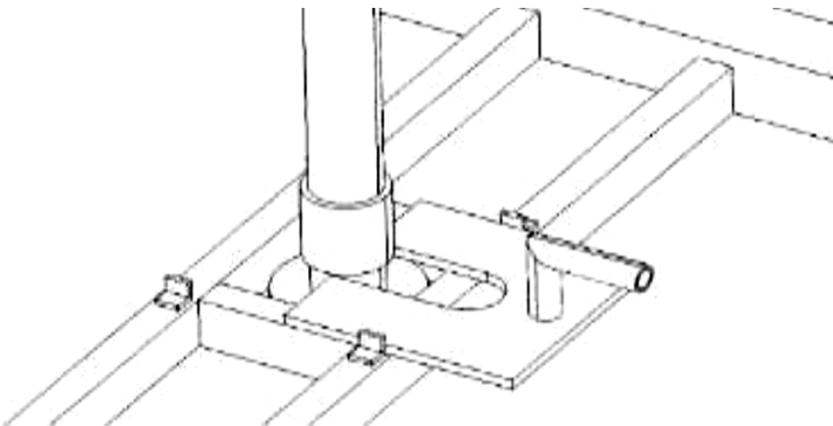


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DRILLING – THE DRILLING PROCESS

- Using the winch, raise the pipe slightly until the Slip will fit under the bottom coupler as shown.



- Continue to run the pump for 3 minutes slowly spinning the wheel to flush out all cuttings.



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DRILLING – THE DRILLING PROCESS

- *NOTE: If rock or harder soil is encountered, the same drilling process is followed.*
- *Controlling the descent rate is extremely important.*
- *However, in order to grind the rock away, it may be necessary to allow the drill bit to fully rest on the bottom, making it more difficult to turn.*



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DRILLING – THE CHANGE OVER PROCESS

- When ready to add a new section of pipe, place a 24" *Pipe Wrench* snug around the coupler on the Slip and turn until it rests against the vertical Wrench Stop as shown.
- Turn the wheel COUNTER-CLOCKWISE to unthread the kelly bar from the pipe string in the hole. The wheel will be much harder to turn than when drilling, but can be turned very slowly. Slowly crank the winch up as it unthreads.

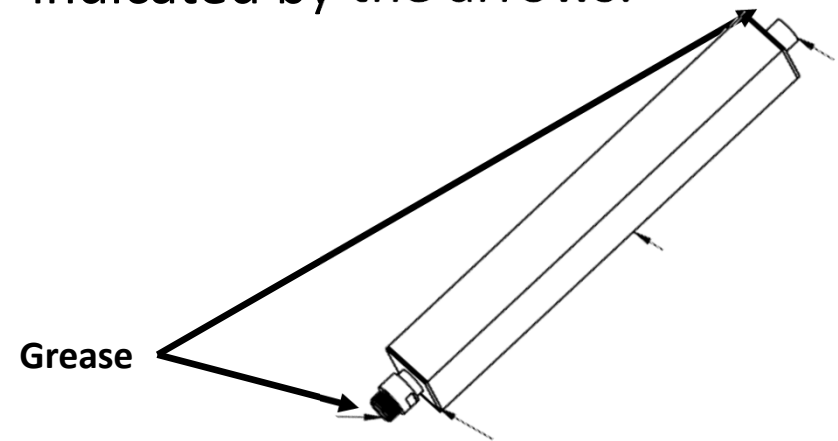
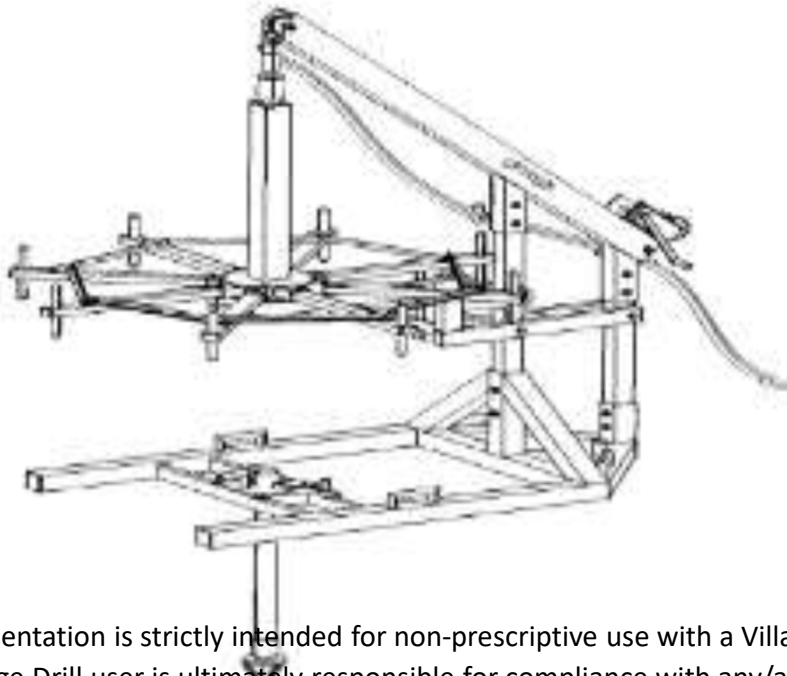


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DRILLING – THE CHANGE OVER PROCESS

- Once unthreaded, lift the kelly bar using the winch until it is at the maximum height.
- On the new segment of pipe (with a coupler already attached on one end) generously spread **Thread Grease** on the open threads and the inside of the coupler as indicated by the arrows.

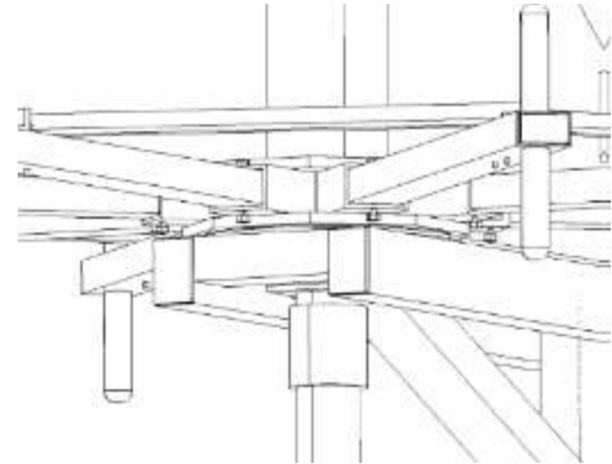
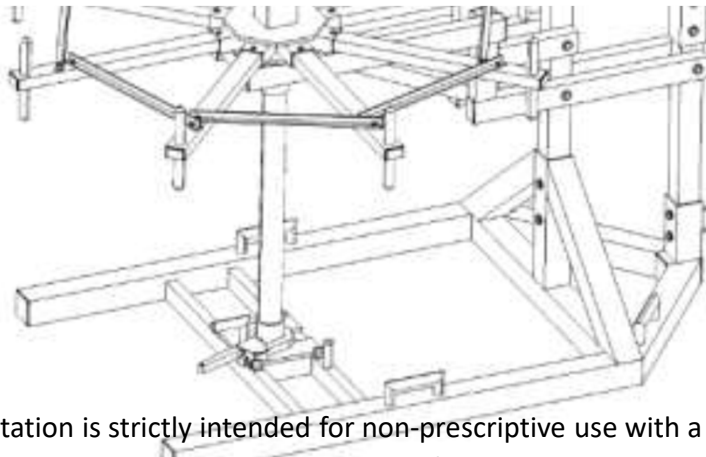


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DRILLING – THE CHANGE OVER PROCESS

- Insert the new pipe into the coupler resting on the slip. Positioning the wrench to stop against the slip handle, thread the new pipe into the coupler by hand, ensuring that the threads line up.



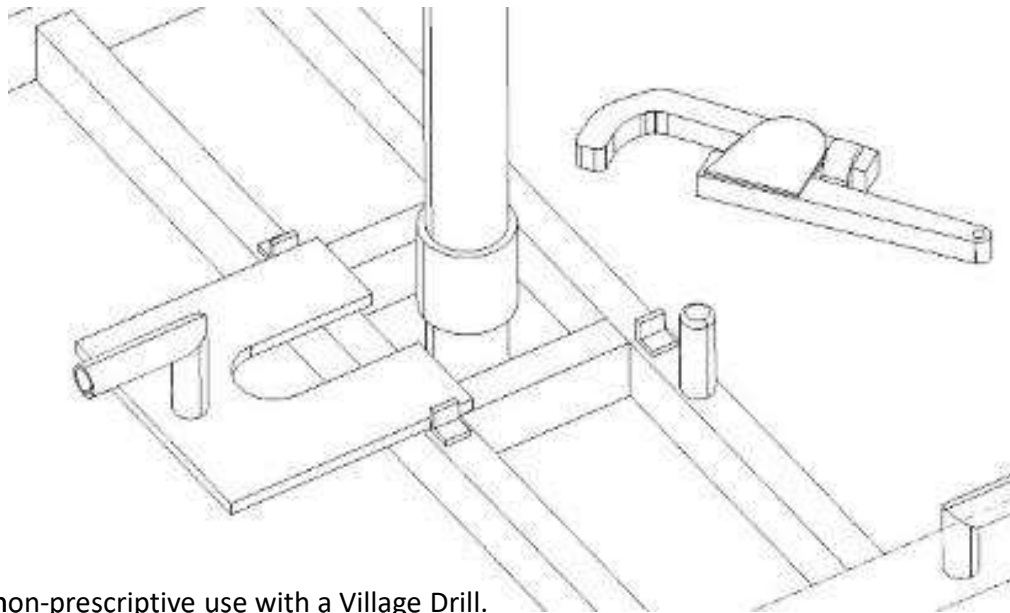
- Lower the winch to rest on the top of the newly added pipe. Carefully (to avoid stripping the threads) turn the wheel **CLOCKWISE** while slowly lowering the kelly bar to thread it into the new pipe.

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DRILLING – THE CHANGE OVER PROCESS

- Once sufficiently threaded (it does not have to be completely tight), remove the wrench and Slip. Run the pump, and continue to turn the wheel CLOCKWISE with all three workers to resume drilling.



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DRILLING – REMOVAL OF DRILL STRING FROM THE BOREHOLE

- When the desired depth is reached (see note below), continue to run the pump for 10-15 minutes to allow all cuttings to be flushed from the hole.
- *Note: Borehole Depth is measured by the number of Bars that have been added to the Drill String. Multiply Bars by 3 (feet) to determine the current depth.*

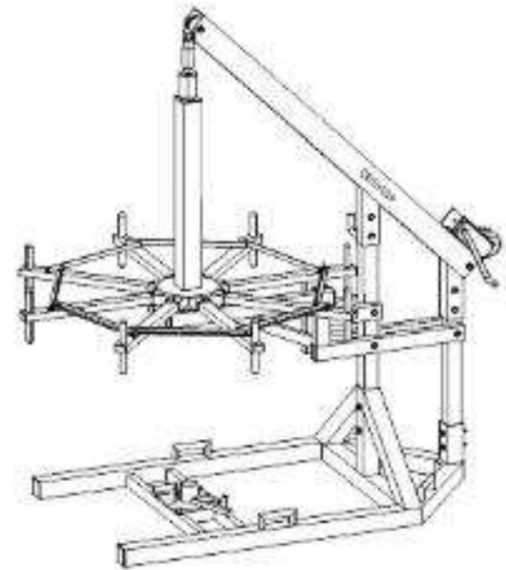
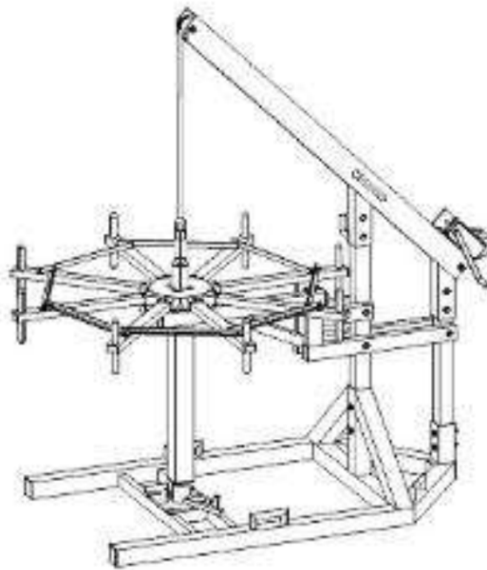
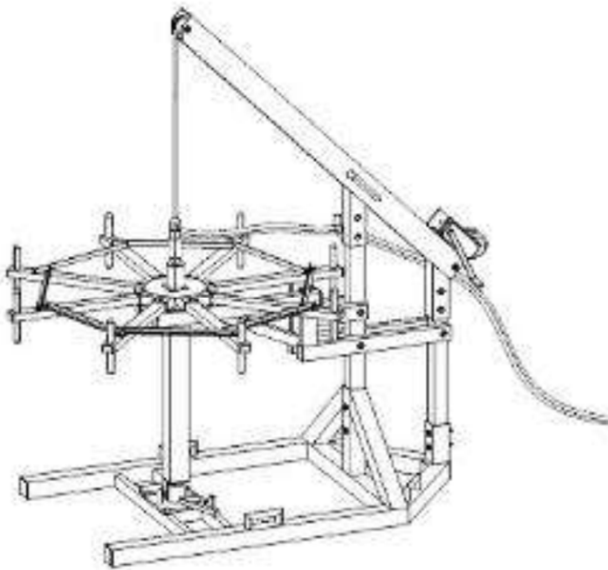


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DRILLING – REMOVAL OF DRILL STRING FROM THE BOREHOLE

- Position slip and wrench.
- Detach the hose from swivel.
- Unthread, and lift kelly bar.

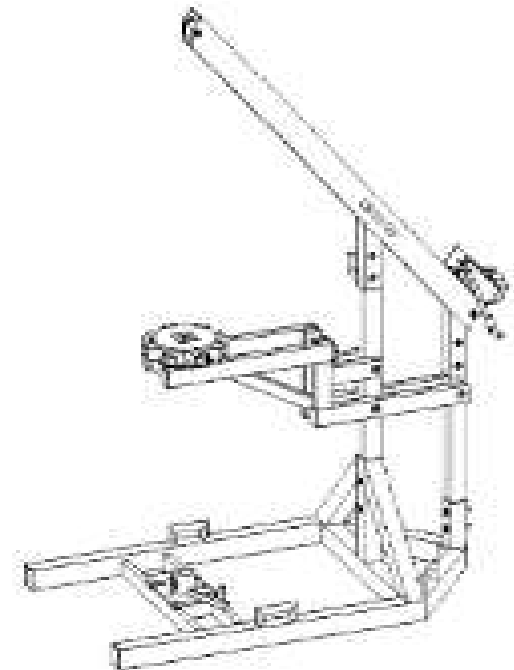
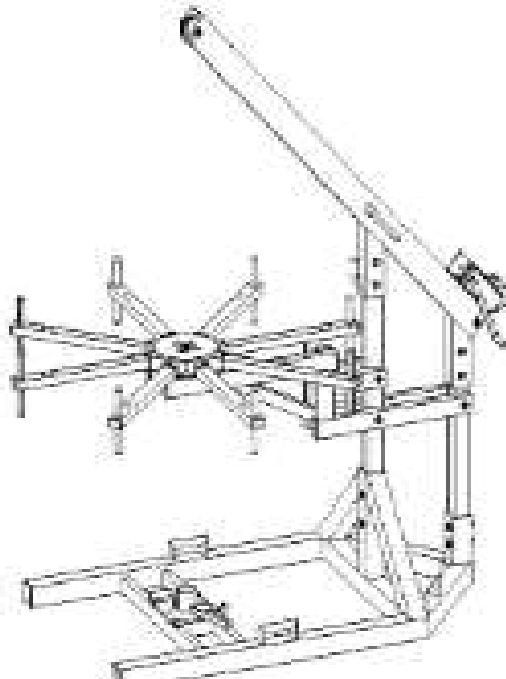
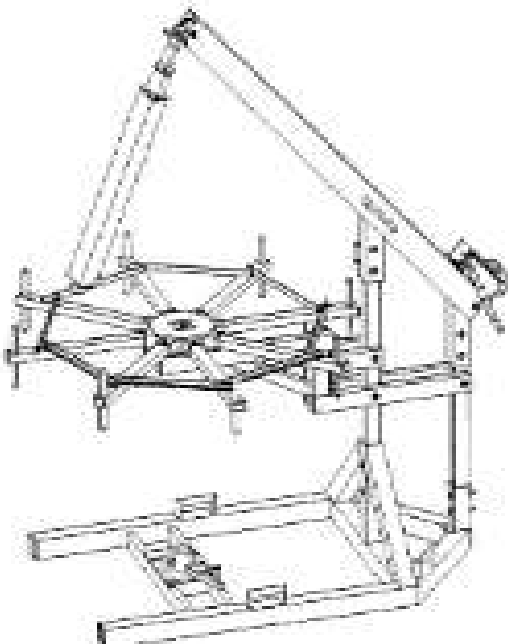


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DRILLING – REMOVAL OF DRILL STRING FROM THE BOREHOLE

- Remove kelly bar.
- Remove spoke braces.
- Remove spokes and bolts.

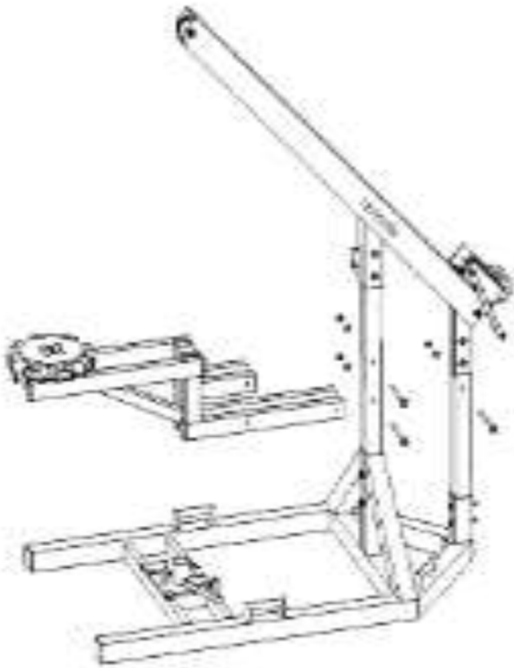


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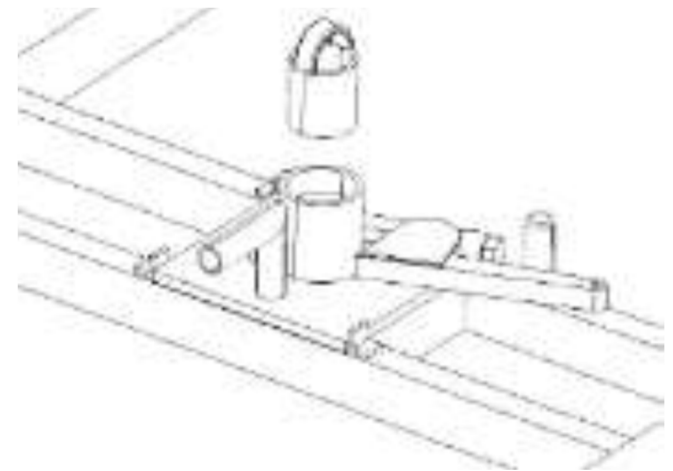
DRILLING – REMOVAL OF DRILL STRING FROM THE BOREHOLE

- Detach support and bolts.



- *Note: During disassembly, be careful not to step on or move the Slip and Coupler at the hole.*

- Thread the hook into the top coupler by hand, securing the pipe with the wrench.

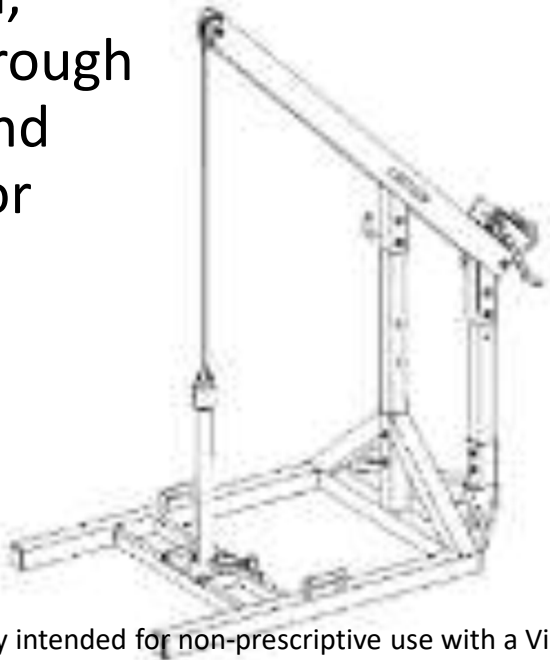


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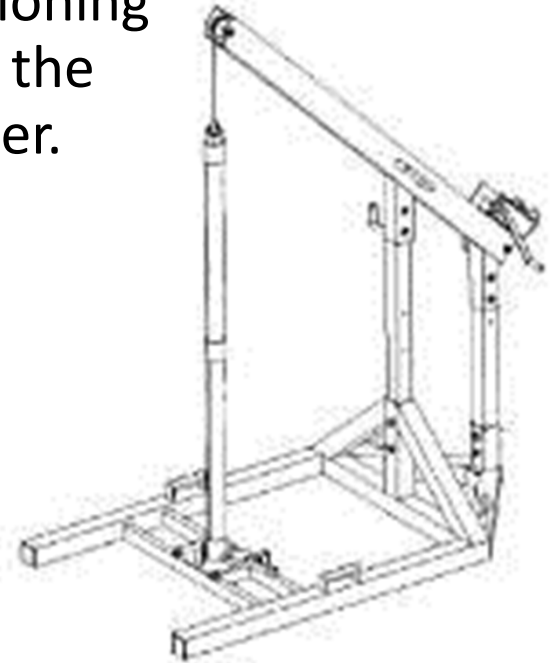
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DRILLING – REMOVAL OF DRILL STRING FROM THE BOREHOLE

- Begin to lift the pipe string with the winch, sliding through the slip and wrench for safety.



- Lift up two pipe segments at a time, repositioning the Slip after the middle coupler.

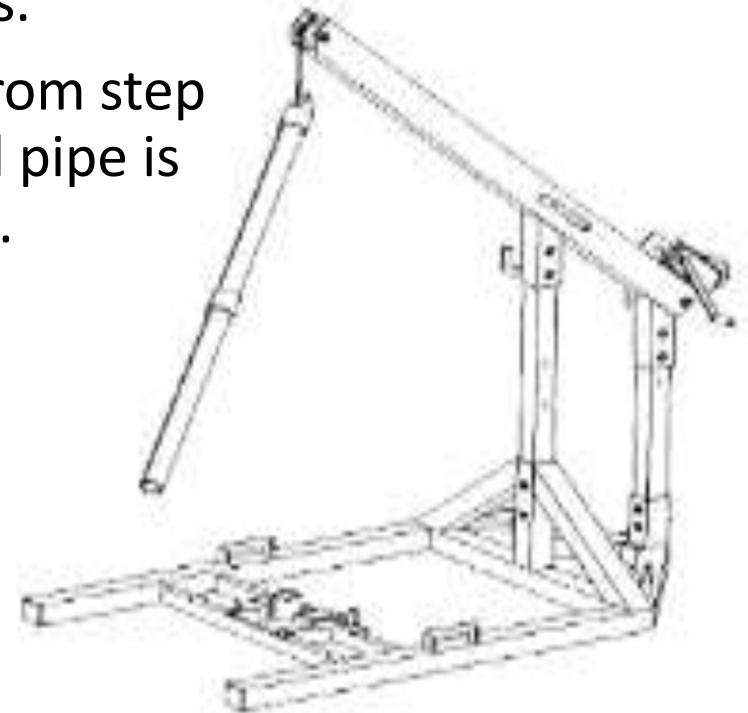
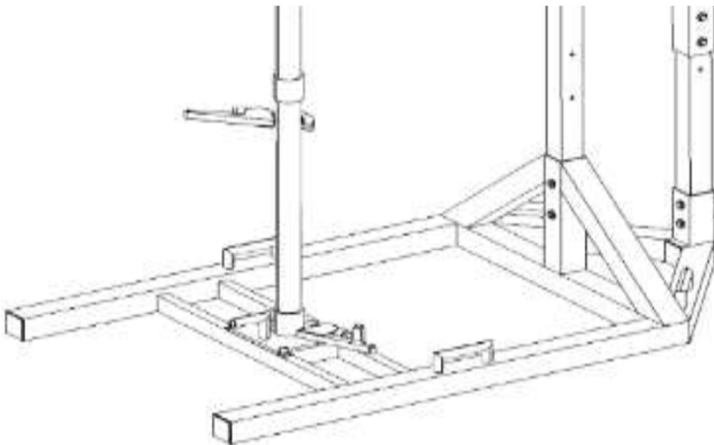


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DRILLING – REMOVAL OF DRILL STRING FROM THE BOREHOLE

- Using two pipe wrenches, loosen the two pipe segments together.
- Remove the pipe segments.
- Repeat from step 9 until all pipe is removed.

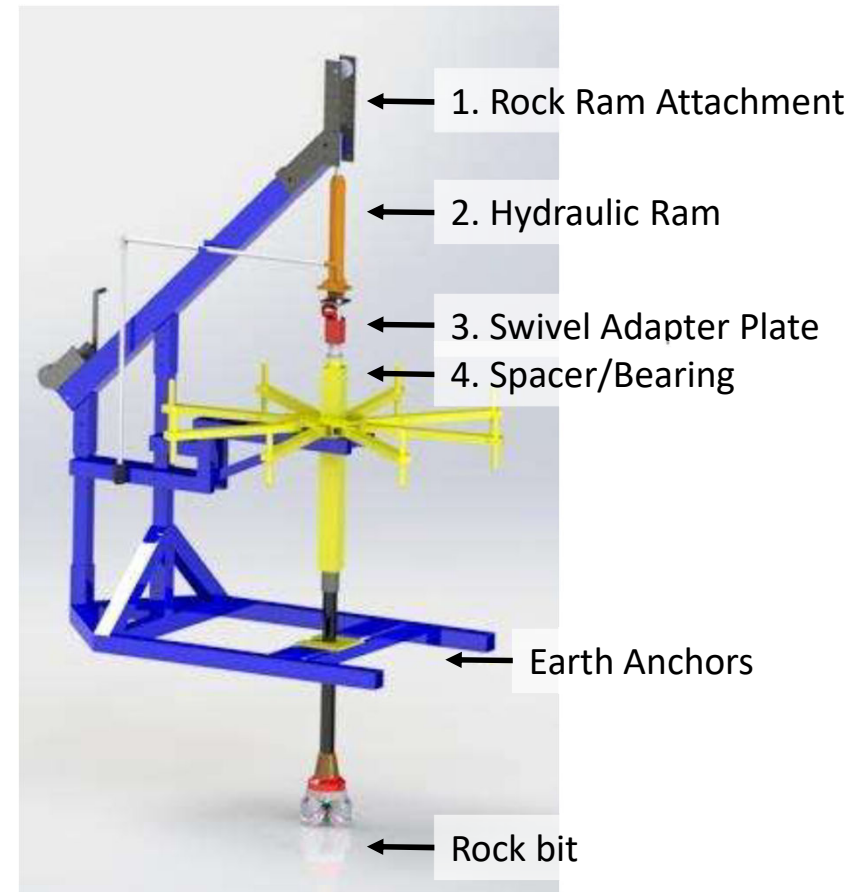


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DRILLING – ROCK RAM ATTACHMENT

- As you drill you may encounter rock or harder formations. In such cases, it is necessary to use the ROCK RAM attachment, until you have successfully passed the harder formations.
- In order to achieve increased force on bit, the ROCK RAM attachment uses a 3-ton hydraulic ram to apply force at the top of the drill string. The ram is able to apply thousands of pounds of downward force as needed, and when not needed, the force can be removed very simply.



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DRILLING – ROCK RAM ATTACHMENT



1. Rock Ram Attachment

2. Hydraulic Ram

The rock ram attachment attaches to the back of the beam using several bolts and attaches to the Hydraulic Ram with a bolt through the top of the ram. The Ram is actuated by hand using a long handle attachment (shown in white).

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DRILLING – ROCK RAM ATTACHMENT



3. Swivel Adapter Plate

The Swivel Adapter Plate attaches to the base of the Hydraulic Ram using a pin/bolt. The Swivel is modified by removing the original u-shaped bolt and replacing it with two straight bolts (four nuts) that allow the adapter to attach to the swivel. The adapter plate is separated from the swivel body by two spacers (shown in white).

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DRILLING – ROCK RAM ATTACHMENT



4. Spacer/Bearing

The spacer is placed between the bottom of the swivel and the bearing. The spacer sits on the INNER race of the bearing. There is a lower spacer that separates the bearing from the Kelly Bar. The lower, larger spacer sits on the OUTER race of the underside of the bearing.

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DRILLING – ROCK RAM ATTACHMENT

- As the weight on the bit increases, the drill must be anchored to the ground.
- This is done with two earth anchors driven into the ground using a metal bar
- When the anchor has been sufficiently driven into the ground, it is “set” by forcefully pulling up on the cable end of the anchor
- The two anchors are then attached to each other using a chain tensioner.



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DRILLING – WARNINGS!

- NEVER SPIN THE WHEEL COUNTER CLOCKWISE - YOU COULD UNSCREW THE DRILL STRING AND LOSE IT DOWN THE HOLE
- GREASE AND OIL FLAT BEARING AND OTHER COMPONENTS DAILY
- INSPECT EVERY DRILL STRING FOR WEAR PRIOR TO ADDING TO KELLY BAR
- DO NOT STAND IN THE “DANGER ZONE” WHILE DRILLING
- LEVEL DRILL AT THE WHEEL FREQUENTLY
- LIFT THE DRILL BIT OFF THE BOTTOM OF THE HOLE EVERY NIGHT, OR IF NOT IN USE FOR SEVERAL HOURS



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DRILLING – WARNINGS!

- LIFT THE BIT OFF THE BOTTOM OF THE BOREHOLE DURING BREAKS
- MAINTAIN A CLEAN WORK SITE, KEEP TOOLS OFF GROUND & DRILL STRING ON TARPS
- MAINTAIN DRILL LOGS - TAKE CUTTING SAMPLES EVERY METRE & SAVE TO EVALUATE
- CREATE A SAFE ZONE AROUND THE DRILL SITE
- ASSURE THAT YOUR BENTONITE OR POLYMER MIXTURE IS ACCURATE
- DO NOT OPERATE THE VILLAGE DRILL WHILE INTOXICATED

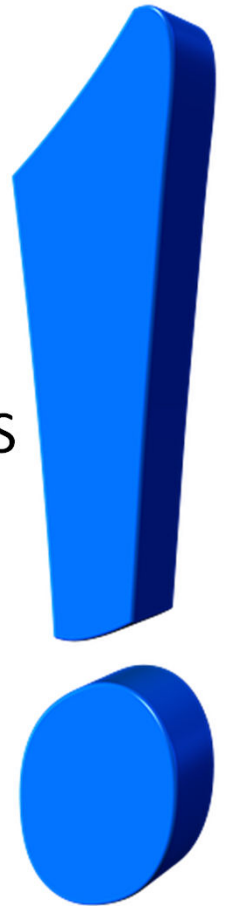


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DRILLING – WARNINGS! - PUMP

- CHECK ENGINE OIL IN PUMP DAILY (FOLLOW OEM MAINTENANCE GUIDELINES)
- CHECK FUEL LEVEL FREQUENTLY
- “PRIME” THE PUMP BEFORE USING
- DO NOT DRILL FASTER THAN THE PUMP CAN EXTRACT THE CUTTINGS
- WHEN ADDING A NEW LENGTH OF DRILL STRING, RUN THE PUMP FOR SEVERAL MINUTES BEFORE SHUTTING OFF TO ALLOW THE REMOVAL OF CUTTINGS / AVOID BIT STUCK IN BOREHOLE
- KEEP WIRE MESH AROUND INTAKE HOSE TO PREVENT ROCKS FROM ENTERING PUMP



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DRILLING – WARNINGS!

- DRAG BIT - for use in all substrate EXCEPT impenetrable material (i.e. rock)
 - LIFE GIVER PDC BIT- for use in rock



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