



VUL-SWP-128-Conduct Exploration Drilling Operations

STANDARD WORK PROCEDURE (SWP)			
Description	Exploration Drilling		
Site	Vulcan Mine		
Department	Exploration Department		
PPE Required		Job Step Analysis Reference	
 Safety helmets must be worn in this area  Ear protection must be worn  Protective footwear must be worn  Protective gloves must be worn  High visibility clothing must be worn in this area  Eye protection must be worn			
		Other Relevant Information	
		☐ Relevant OEM instructions & specification available	
VUL SOP Reference	ERT resources available on-site during operations.		
The purpose of this SWP is to provide a documented way of working to achieve an acceptable level of risk. The steps outlined pertain to the titled task only. All other SHMS requirements such as SOPs must be followed e.g., VUL-SOP-065-PPE, VUL-SOP-089-Dust etc.	All Drill operators are to be trained and assessed as competent. This competence must be current and equivalent to Certificate III in Drilling Operations		
	All Drill operators must be authorised to operate before conducting drilling operations at the Vulcan mine.		
People, Equipment, Materials and Tools Required			
People	Equipment	Materials	Tools
Competent and authorised operator.		Drill prestart and equipment check list	Drill signage
		Personal Hazard identification tool - Take 5	



1 DRILL RIG SET-UP AND PACK UP

1.1 Potential Hazards

Potential hazards associated with drill rig set-up and pack up could include, but not limited to:

- Park Rig in Correct Location
- Unload heavy equipment
- Position jacking plates under jacks (if required)
- Using all jacks to raise rig to appropriate level and position
- Setup Mud tank (If required)
- Lowering of drillers step / platform
- Above / underground services

1.2 Ensuring Site Suitability, Accessing Site, and Parking Rig in Correct Location

- Permit to disturb to include required size (e.g., minimum dimensions) and layout of drill pad and width of track. Drill site appropriateness to be assessed and approved by driller/driller supervisor (or delegate). Ensure copy of PTD is with operators clearing tracks and pads as well as with supervisor.
- An example of a functional drill site layout with a truck mounted rig and rod truck is shown in Figure 1. For a truck-mounted rig without rod handler, a good rule is to allow at least 15m X 15m for pad (including track width) in order to allow safe movement of personnel around site.
- Prior to mobilizing rig to site, confirm site location by confirming checklist details (site numbers) on site peg and map or with geologist.
- Visually inspect rig site for overhead hazards, check for underground utilities. Dial before you dig and / or verify with Supervisor before commencing drilling. All equipment to use designated signpost crossing for passing under power lines. If there are no signs the SSE will be notified and made aware.
- Permission must be sought from SSE before proceeding under power lines. Should any equipment contact live power lines operator is to stay inside vehicle / machine cabin-initiated site emergency procedure, Supervisor / SSE will organise power isolation / shut down.
- Should rubber tyre vehicles come in contact live power lines, equipment is to be parked in an area clear of people, tyres shall be inspected by a competent person and must be left for a 24hr period before returning equipment to work.
- Before travelling, all equipment to have max working height label, and an operating radio. Drill Rig operators must maintain a safe distance of 15mtrs from power lines at all times unless site procedures specify a greater distance. THIS MEANS THE CLOSEST POINT OF YOUR RIG MUST NOT BE WITHIN 15M (OR GREATER IF SPECIFIED UNDER SITE SHMS) FROM POWER LINES
- Remove trip / fall hazards. Also clear any long grass that may conceal snakes or cause fire hazards.
- Ensure all vehicles are parked a safe distance away from sumps or mud pits. Ensure an adequate distance from previous boreholes to avoid loss of circulation with air escaping in fractures and cracks created from preceding borehole(s).
- Set-up Rig and support vehicles that allows a safe working distance within Rig and support vehicles. If in doubt while reversing Rig over correct location, get another crew member as spotter and guide Rig into position. Engage Park brake and chock vehicles then Pre-start equipment prior to commencement of work.

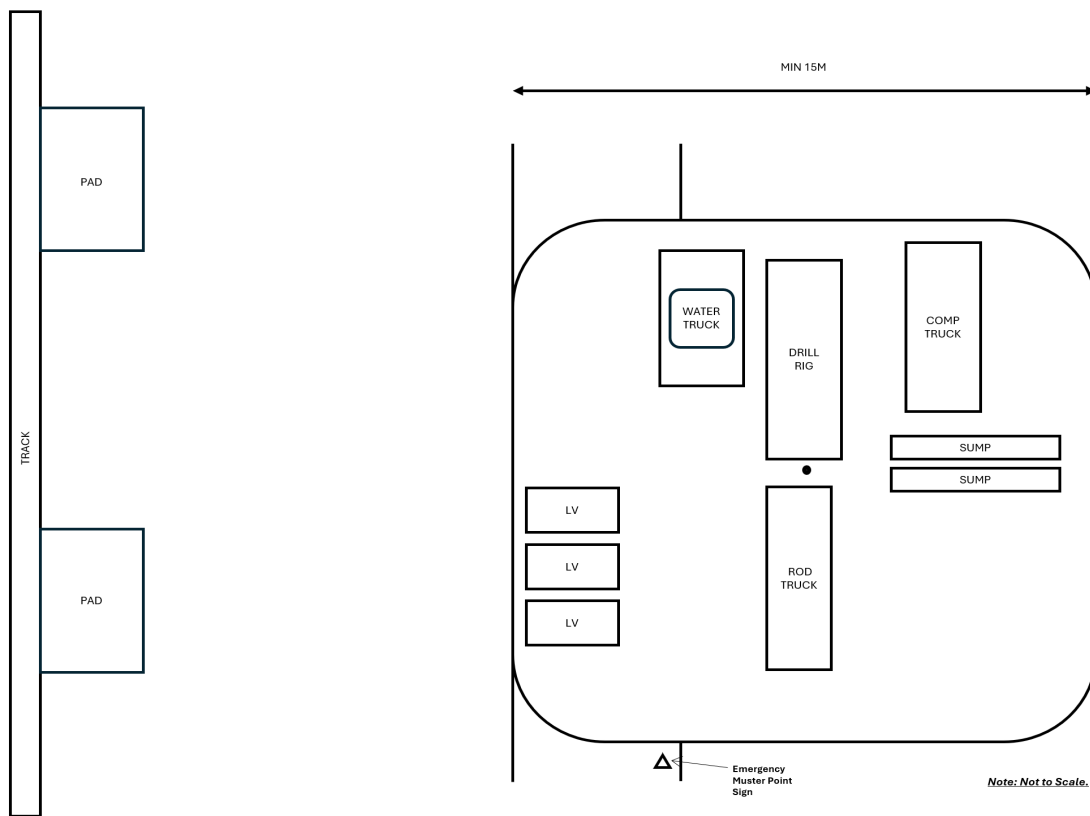


Figure 1 – Example of a Drill Pad Set-up

1.3 Unloading Heavy Equipment

- Manual handling VUL-SOP-096(b)-Manual Handling Tasks & Ergonomics tasks to be Risk Assessed if deemed too heavy request assistance or find alternate means VUL-SOP-072(e)-Lifting Operations. Unusual / difficult tasks / conditions shall be assessed with a Take 5 / JHA. Follow VUL-SOP-096(b)-Manual Handling Tasks & Ergonomics and ensure adequate PPE is worn at all times, in accordance with VUL-SOP-065-PPE.
- Before unloading, find a firm dry surface to ensure footing prior to unloading equipment.
- Unload heavy equipment with mechanical means where practical. Ensure all staff not required are out of the drop zone, communicate at all times in the event of uncontrolled movement of equipment, to ensure everyone's safety.
- In the event of moving casing, upon releasing straps, ensure all staff are out of fall zone in the event of uncontrolled movement.
- Place items core barrels / stabilizers / hammers in a convenient, safe, and easily accessible position to minimize manual handling, avoiding trip hazard, cuts, and abrasions from sharp edges.

1.4 Positioning Jacking Plates Under Jacks (If required)

- Determine size and number of jacking plates required for hole depth consider ground conditions, size of base plates on jacks (width of jacking plates width of base plates). Expected hole conditions such as ground water are to be considered.
- Use correct lifting procedures following VUL-SOP-096(b)-Manual Handling Tasks & Ergonomics. Wear gloves
- handling logs, in accordance with VUL-SOP-065-PPE.



1.5 Using All Jacks to Raise Rig to Appropriate Level and Position

- Only raise rig such that wheels to stay as close as possible to the ground. Conduct regular checks on bedding logs throughout drilling process.
- Lock off jacks to avoid jack movement (Only related to UDR650)

1.6 Setting Up Mud Tank (If required)

- Manual handling tasks to be Risk Assessed if deemed too heavy request assistance or find alternate means. Unusual / difficult tasks / conditions shall be assessed with a Take 5 / JHA. Follow VUL-SOP-096(b)-Manual Handling Tasks & Ergonomics. Always wear PPE in accordance with VUL-SOP-065-PPE and stay out of drop / crush zones. Set-up to ensure sharp edges, if any, are well away from work area. Ensure set-up of Mud tank / Offsiders platform is on firm dry surface.
- Determine weight, 20 to 55kg, control measures must be considered, such as a team lift. Loads over 55kg will require the assistance of a mechanical aid. Set-up of Mud tank requires the assistance of a mechanical aid e.g., Winch or the use of a Backhoe. Positive communication at all times when utilising mechanical aids / Backhoe / mechanical aids used only by a competent, authorised Operator.

1.7 Lowering of Drillers Step / Platform. Attaching Step Extension (DR950) / Place Safety Step at Bottom of Rig Deck Foldable Ladder. (If Applicable)

- Wear PPE in accordance with VUL-SOP-065-PPE, communicate lowering of step, Personnel to stay clear of drop zone during lowering procedure
- Place safety steps where required.

1.8 Moving Offsiders Platform

- When removing or replacing platform, a team lift, follow manual handling procedures and / or mechanical aid must be considered.
- Ensure platform is structurally sound at all times. If detached from the Rig, ensure stabilized with metal blocks at the (front legs adjusted ensuring stability) or brackets / legs in all four corners. Use purpose made smaller / lighter Offsiders platform, whilst using Mud tank.

1.9 Slowly Raising the Tower to Vertical Position

- Check tower for any tree branches that may have lodged during journey to site.
- Check all personnel are clear of 'NO GO ZONE' at rear base of tower. Ensure nothing can fall from top of tower. Driller to give a clear audible indication / warning that the tower is about to be raised.
- Engage control for mast elevation until vertical, raise at an appropriate speed by adjusting engine revs.
- Install mast locking pins/wedges and hydraulic locks if supplied. Use hydraulic locking pins if available.
- Driller to ensure hydraulic locking pins/ manual lift wedges are not in locked position whilst raising tower and lock as soon as tower has been raised.
- Wear gloves when locking pins/wedges are utilized to prevent possible pinch point, stay well away during raising / lowering process.

1.10 Final Adjustments to Rig Level and Vertical Check Tower



- Place spirit level on the left rear of the rig to check for level. Then place spirit level on rear of tower to check level. If ground conditions are wet / muddy, sinking may occur, so constantly check if level whilst drilling.
- Repeat process front to back using stabilisers legs to adjust accordingly. Lock off jacks to avoid jack movement.

1.11 Pack Up

- Heavy Items to be lifted into position with haul winch or sand line before lowering tower including the removal of t-piece from hole, eliminate manual handling where possible. Head rod stored in travel position. Rig may need to raise the work platform using the jib winch to lift to travel position as required. Hoisting lines are raised to hang freely of obstructions and secured by applying brake mechanism. Remove any built-up pressure from hoses prior to disconnecting as per VUL-MOP-080-Fluid Above and Below Atmospheric Pressure and VUL-SOP-072i-Transporting Heavy Plant and Supplies.
- Air, mud pump and water hoses disconnected and stored appropriately. Drill Rig operators must ensure mast is fully lowered prior to driving off.
- Communicate work instructions while working on the back truck, Positive communication while raising and lowering equipment is essential.

1.12 Ensure Items in the Tower are Secure

- Reapply breaks as needed. Ensure tower / rope is free of entanglement prior to Lowering. Check branches have not been caught up in tower during drilling operations or idle time.
- Check storage of equipment to avoid falling from top of tower when lowering, good housekeeping. Remove and secure spin cage as required, to ensure it does not open, creating a hazard while lowering the tower.

1.13 Lowering of Tower

- Driller to remove disconnect / release physical barrier / lock device from tower control (if fitted).
- Driller gently moves tower against stoppers to release pressure on stop wedges. Driller to deactivate hydraulic tower locking pins for UDR650. Driller to release hydraulic ram locking mechanism for DR950.
- Driller to give a clear audible indication / warning that tower is about to be lowered. Tower is lowered slowly into horizontal position with all personnel checking for snagging of cables and chains on machinery components. Tower is rested onto support brackets. Personnel to stand clear or rear or base of tower 'NO GO ZONE' as it is lowered. Personnel shall not be working on deck of drill rig whilst being lowered.

2 COMMENCEMENT OF DRILLING

2.1 Potential Hazards



The potential hazards associated with commencement of drilling could include, but not limited to:

- High Pressure
- Pinch Points
- Uncontrolled Movement
- Static Shock

2.2 Clearing Work Area to Access Beneath Rigs

- Use gloves to protect against sharp edges / pinching as per VUL-SOP-096(b)-Manual Handling Tasks & Ergonomics.
- Use Lifting aids / team lifting for heavy items where possible as per VUL-SOP-072(e)-Lifting Operations.
- Remove or raise steps and secure etc. to allow clear access beneath working table.
- Place surface casing if required. Insert dust deflector mat / guard on rear of rig.

2.3 Commence – Mud Drilling

- Position barrier guard to protect against rotating rods, cage must be closed for rotation to work correctly. Place rear dust deflector guard / mat in position. Communicate intention to commence drilling and clear personnel (not required) from immediate area.
- Make sure delivery line is left open and check for circulation from bit. Lower drill bit to surface.

2.4 Commence – Air Drilling

- Position barrier guard to protect against rotating rods, cage must be closed for rotation to work correctly. Place rear dust deflector guard / mat in position. Communicate intention to commence drilling and clear personnel (not required) from immediate area.
- When positive communication is received from the personnel in the immediate vicinity, Driller can begin drill operation and partially open delivery line and check for circulation from bit. Lower drill bit to surface.
- Driller to inject water periodically to reduce excessive dust if commencing with air circulation, hearing protection worn with all appropriate PPE as per VUL-SOP-065-PPE.

2.5 Commence – Diamond Coring

Follow these steps to commence coring from surface:

- Engage head traverse to raise head taking slack on core barrel.
- Engage foot clamp control to release foot clamps from barrel.
- Position barrier guard to prevent entanglement hazard.
- Engage bean pump to check circulation through core bit.
- Set bean pump to correct fluid injection rate.
- Engage rotation control to rotate core barrel.
- Disengage holdback control lowering bit onto surface.
- Commence Coring

2.6 Commence – Cleaning Hole



For cleaning holes, the subsequent steps are to be followed:

- Collect information regarding hole e.g., TD, condition of hole, depth of blockage, hole diameter etc.
- Set rig up over existing hole_
- Trip rods into hole approx. twelve meters above blockage.
- If blockage is encountered remove two rods from hole.
- Start circulation slowly to lift water from hole.
- IF USING AIR DO NOT OPEN AIR FULLY UNTIL WATER IS FLUSHED FROM HOLE
- OPERATOR NOT TO LEAVE CONTROLS UNATTENDED
- Add another rod as per relevant _
- Open air slowly maintaining hold on brake / hold back. Once water is clear, open air as required rotating rods while lowering through blockage.
- Add rods to bottom of hole or next blockage in the same manner.
- IF HOLE IS NOT BLOCKED AND IS REQUIRED TO BE DEEPEMED FLUSH THE HOLE CLEAR OF WATER IN REGULAR INTERVALS BEFORE COMMENCING DRILLING
- Casing can be pushed up hole and into tower when expelling water and damage seals on THD.
- Ensure table is secure or skillet is in position when first blowing out water on table drive Rigs.
- Flying particles and high-pressure air / fluid should be ClaCable whilst cleaning hole. Precautions should be taken. Hearing protection worn with all appropriate PPE per VUL-SOP-065-PPE.

2.7 Installation and Use of T-Piece

- Predrill T-Piece hole with the appropriate size and type of drill bit. Cover pre-drilled hole (shovel) and remove bit, install T-Piece into hole. Fit drill bit and lower through T-Piece and place wiper rubber (if applicable). Fit wiper rubber around rod and fit clamp keeps fingers clear from inside clamp and locking mechanism. If required, PVC casing to extend the chute. Keep hands well clear when fitting wiper rubber, ensure gloves PPE is worn. Follow VUL-SOP-096(b)-Manual Handling Tasks & Ergonomics and team lift where possible.
- OBSERVE FOLLOWING POINTS:
 - Depending upon the application and the type of drill rig it is recommended that the T-Piece assemblies be utilised for drilling operations and installed when appropriate using the Drillers discretion.
 - The purpose of the T-Piece is to control dust / control flying particles and reduce manual handling of drill cuttings by directing them to containment pits.
 - The T-Piece has a short steel Shute extending from the side of the main body. Generally, a piece of PVC casing is inserted into this Shute to extend the Shute to provide greater control and direction of drill cuttings.
 - DO NOT USE TWO SMALL LENGTHS OF PVC OFF CUTS, IF THEY SEPARATE WHILE PERSONNEL ARE COLLECTING CUTTING FROM THE T-PIECE, THERE IS RISK OF INJURY.
- In dry drilling there is the potential for PVC Shute to charge with extensive static electricity. It is recommended that water injection be used at completion of drill hole to provide earth for any static.

2.8 Removal of T-Piece



- Remove drill string, ensure bit is clear of T-Piece and Shute extension. Remove clamps and wiper rubbers, watching for pinch points, maintain PPE (gloves) at all times. Use lifting aids e.g., sand line / haul line where possible or invoke team lifting, follow VUL-SOP-096(b)-Manual Handling Tasks & Ergonomics

3 ROD CHANGE AND ASSOCIATED TASKS

3.1 Potential Hazards

Potential hazards associated with drill rig set-up and pack up could include, but not limited to:

- Rotating parts
- Pinch Points
- High Pressure
- Uncontrolled Movement
- Failure of lifting equipment
- Entanglement
- Falling Objects
- Vibration

3.2 Break Out Drive Sub / Head Rod on THD Rigs

- Open / Position rod spin guard, free of work area and skillet / spanner to rod and lower into table for THD Rigs.
- Apply breakout tongs head rod, ensure hands are clear and PPE (gloves) worn.
- Activate power stilsons or span wraps until thread is uncoupled. Hands clear of rotating parts, PPE (gloves) in accordance with VUL-SOP-065-PPE. Be aware of over torquing of threads / joints, slow and steady to avoid kick back.
- On THD rig once head rod thread is loose, Driller is to rotate slowly anticlockwise until head rod undone from down hole string.
- The driller is to take particular care when undoing head rod, making sure the head rod does not undo from drive sub when rotating anticlockwise. Remove any blow out / non return valves, generally require to be broken out prior to removal of head rod. Stand clear of any high pressure / air water venting from head rod, Driller to ensure staff to stand clear at this point.
- The driller then traverses head up and racks it away read for adding the next rod unless the drill string is still to be removed.
- Use skillet / spanner / retractable table spanner or span wraps to perform this task, keeping hands free of pinch points and whilst rotating. Keep staff out of 'DROP ZONE.' Use closed fist method whilst using skillet and be aware of burrs on pipe / rods. Communicate at all times and wear PPE.

3.3 Raising Rods from Hole / Truck / Trailer Using Hoist / Main Winch or Clam Shell

- Check your depth. Equipment is suitable for the job. Assistant moves to position out of direct line of movement of raised drill pipe. Driller to ensure personnel of rod rack side of rig. Or Rod truck, 'NO GO ZONE' must be clear, never under suspended loads. Allow hoist chain to stabilize before lowering plug onto down hole drill string. Assistant to screw hoist plug / haul plug into rod firmly, Driller and assistant to visually check that hoist plug / haul plug tightened securely into rod, check there is no chance of sand line catching, while being removed from hole. Correct PPE in accordance with VUL-SOP-065-PPE.



- From hole, Driller raises pipe in a smooth controlled manner until it reaches the hands of the assistant. Assistant then secures bottom of drill pipe and guide the pipe over for uncoupling. Assistant to unscrew the rod manually.
- When using clam shell be sure winch rope is correctly spooled, assistant make sure line between clam shell and hook / handle has no slack. Driller raises in a controlled manner as assistant holds rod using hook / handle, Driller and assistant monitor lifting gear while rod is raised. Assistant to never walk under suspended load and second assistant stands to the side of the rig, watching for falling objects.
- When lifting from stands a tag line should be used and positive communication between assistant and driller with the added help of the third assistant as a spotter to avoid snagging when lifting off-center, to the tower. When raising from truck / trailer be sure the truck / trailer is lined up at the center of rig tower to avoid rod swing. Watch footing at all times and ensure rod cage is out of the way to avoid pinch points. Use a tag line, positive communication, PPE in accordance with VUL-SOP-065-PPE.

3.4 Lower Pipe into Hole Including - Connecting Pipe to Drive Sub Using Clam Shell

- Driller to raise drill string allowing assistant to remove slips / skillet / spanner. Drillers then lowers drill string into hole until tool joint approaches table apply slips / skillet to break out flat (BOF) and lower into table.
- When using Clam Shell, once rod is in position in tower the driller lowers the drive sub / head and assistant lines up the top box thread with the drive sub pin thread. Once the threads meet, the driller engages rotation slowly to couple up the raised rod thread to the drive sub. Driller then lowers the clam shell winch while simultaneously the assistant removes the hook from the bottom of the raised rod. When the clam shell reaches the bottom of the rod the assistant hands clam shell and hook to other assistant the next rod or to put away for storage.

3.5 Re-Couple Head Rod / Added Rod and Re-Commencing Drilling

- Remove hoist / haul plug from previous pipe. Insert hoist / haul plug into head rod / next length of pipe and tighten immediately. Driller to take weight on haul winch line to ensure plug does not unscrew during operations. Lower rod into position, skillet off at tool joint, remove hoist / haul plug and repeat process. When using Clam Shell, the driller then lowers the added rod to the down hole string using slow traverse down function, then make up the thread using a combination of slow rotation speed combined with minimal weight to avoid cross threading.
- Upon removing hoist / haul plug from down hole rods, return haul winch line to standby position outside rod rack of rig. Driller's assistant can focus on screwing hoist / haul plug into next rod when ready to re-commence drilling. Never stand under suspended load.
- Driller must remember to take weight online to avoid vibration uncoupling the plug while rod is in rack or truck waiting to be added to drill string.
- Driller to re-commence drilling when head rod is attached and upon repositioning rod spin guard.

3.6 Tripping Rods Out

TO REMOVE RODS FROM HOLE, PERFORM ABOVE STEPS IN REVERSE ORDER

NOTE: When removing rods from bore hole making gas refer to VUL-MOP-142-Flammable and Toxic Gas in Work Environment and follow these basic steps:

- Reduce tripping speed to avoid excessive displacement of water from borehole.
- Inject or pour water into top of borehole to maintains the "Weight" in the hole to deep the gas under control.



- At the last ten rods, stop tripping.
- Shut down the kill line, if in use.
- Wait a few minutes for water to settle and inspect there is no flow of water. Maintain water levels.
- Once confirmed there is no flow and water level maintained then it is safe to trip out remainder of the rods.

4 CHANGE STARTER BIT

4.1 Potential Hazards

Potential hazards associated with drill rig set-up and pack up could include, but not limited to:

- Pinch Points
- Sharp edges
- Uncontrolled Movement
- Burn
- Cross threading
- Over Torque of joints

4.2 Remove Starter Bit from Head Rod

- Cover hole to prevent drilling equipment falling down hole. Clear area to allow room to swing sledgehammer, use correct size hammer. Communicate when about to swing hammer, have bystanders stand clear.
- Hit starter bit to break thread. Ensure PPE is used in accordance with VUL-SOP-065-PPE. Emphasis on
- EYE PROTECTION, GLOVES and HEARING PROTECTION, be aware of flying metal particles.
- Unscrew with hands for the last few threads, if necessary, to avoid bit dropping.
- Keep hands to the side and not underneath in case bit slips, fingers are not crushed.
- Wear PPE. VUL-SOP-065-PPE.
- Driller to ensure head rod is stationary, no movement while breaking out starter bit.
- If not successful use alternative method, as suggested below.

4.3 Remove Starter Bit from Kelly Bar or Head Rod. Alternative Method.

- Cover hole to prevent drilling equipment falling down hole. Fold and secure steps out of way to allow clear access to bit. Ensure the area is clear of personnel.
- Use oxy and acetylene to heat bit (must observe VUL-SOP-096c(ii)-Hot Work. Fire
- Extinguisher nearby. Competent and Authorised personnel only.
- Using appropriately sized hammer to hit bit until loose.
- Unscrew with hands for the last few threads, if necessary, to avoid bit dropping.
- Keep hands to the side and not underneath in case bit slips, fingers are not crushed.
- Wear PPE in accordance with VUL-SOP-065-PPE.

4.4 Remove Bit from Stabilizer

- Remove stabilizer from hole and lay away from trip hazards with bit end elevated to allow bit to be broken out by a sledgehammer. Use a tag line to pull out while driller operates haul winch.
- Hit starter bit to break thread. Ensure PPE is used in accordance with VUL-SOP-065-PPE.



- Emphasis on EYE PROTECTION, GLOVES and HEARING PROTECTION, be aware flying metal particles.
- Unscrew with hands for the last few threads, if necessary, to avoid bit dropping.
- Keep hands to the side and not underneath in case bit slips, fingers are not crushed.
- Wear PPE in accordance with VUL-SOP-065-PPE.
- ENSURE DRILL TOOLS ARE DISCONNECTED FROM HAUL PLUG WHEN THIS TASK IS CARRIED OUT.

4.5 Attaching Starter Bit to Kelly Bar or Head Rod Stabilizer

- Competent Driller and Assistant competent in procedure. Good communication between Driller and Assistant. Training.
- Sand line or haul winch used to carry heavy starter bits in place, (Use tag line). Once in place and supported by skillet in the table if required.
- ENSURE DRILL TOOLS ARE DISCONNECTED FROM HAUL PLUG WHEN THIS TASK IS CARRIED OUT.
- Ensure correct PPE is used.
- Thread tool wick, place some grease on thread to help prevent over torquing of bit and proceed to screw new starter bit back on. Avoid cross threading.
- Fit sub to the starter bit which allows the sub to be secured into the table and broken out using break out tongs.

5 REMOVING RODS FROM A HOLE AND RUNNING OUT

5.1 Potential Hazards

Potential hazards associated with drill rig set-up and pack up could include, but not limited to:

- Unexpected release of stored energy / pressure
- Pinch points / crush
- Uncontrolled movements
- Falling Objects
- Suspended loads
- Poor housekeeping
- Snagging of winch line
- Uncoupling of rods
- Lifting equipment failure

5.2 Lift Head Rod from Hole and Breakout Tool Joint

- PPE (Gloves) in accordance with VUL-SOP-065-PPE.
- After reaching the desired depth hole is flushed to clear all cuttings compressor is shut off.
- Use blowdown valve to release pressure in down hole rods.
- Lower or remove table barrier / guard.
- Lower Kelly / Head rod. Stand clear and watch rod until lowered.
- Breakout Kelly / Head rod. Ensure pressure has been released.
- Drill string is supported in table by clamps or skillet / rod spanner.
- Breakout of pipes and raised into rat hole position or racked away on THD rigs.
- Driller to ensure head rod is completely raised and racked out of the way before commencement of tripping on THD Rig.
- In the event of an extended tripping out period, remove head rod completely or break off three metres
- when diamond coring.



- Fully raise and rack remaining drill pipe eliminating pinch / crush with head rod and drill pipe.
- People not directly involved should stand away from 'NO GO ZONE.'
- Refer to VUL-SOP-096(b)-Manual Handling Tasks & Ergonomics.

5.3 Lift Pipe from Hole

- PPE (Gloves) in accordance with VUL-SOP-065-PPE.
- Insert lifting hoist / haul into drill pipe supported in (rotary) table.
- Raise pipe until next tool joint is accessible. Watch pipe being raised to ensure there is not any snagging or haul plug does not uncouple.
- Apply skillet / rod spanner into tool joint and lower into table ensuring skillet / rod spanner is gripped by the handles.

5.4 Breakout pipe

- Emphasis on EYE PROTECTION, GLOVES and HEARING PROTECTION, be aware flying metal particles.
- Driller activates the break-out function until thread is loose enough to be unscrewed by hand.
- Hydraulic stilsons ram should be closed when reversing.
- Keep hands well away while rotating.
- Rods may be excessively torqued up, if rods are locked up, any people not directly involved in the procedure should stand away from the 'NO GO ZONES.'
- If the drill pipe threads are tight and are unable to be broken out via the conventional method, a JHA must be completed.
- Continue rotation until thread disengages, once complete disengage the rotation control.
- Stand well away from rotating parts, have long hair tied up under helmets so cannot be caught in any moving parts.
- • Watch break-out function until thread is disengaged, communicate when thread is free, and assistant can unscrew pipe / rods by hand.

5.5 Place Rod in Storage Position

- Driller to ensure all personnel clear of rod rack side of rig or underneath suspended load 'NO GO ZONE.'
- Lift the extracted pipe clear of table.
- Watch pipe being raised to ensure there is not any snagging or haul plug does not uncouple.
- Grip rod with right hand approx. 150mm from bottom of tool joint.
- Pull rod out and around to the slide, use left hand to steady self by gripping mast upright.
- Hold rod over rod slide and release when it makes contact with the rod slide.
- After rod begins to slide, offsider moves out of line of rod and rod rack and watches rod being lowered.
- Driller observes position at offsider.
- Communicate lowering of rod.
- Lower rod into storage position at controlled speed.
- Remove hoist / haul plug. Follow VUL-SOP-096(b)-Manual Handling Tasks & Ergonomics.

5.6 Rod Stored on Truck – Trailer or Stands



- Driller to make sure rod stack on truck / trailer is central to tower to avoid snagging of lift gear and rod when running onto truck / trailer.
- When running the rod onto truck / trailer, lift the extracted pipe clear of table.
- Watch pipe being lowered to ensure there is not any snagging or haul plug does not uncouple.
- Break out pipe, Manoeuvre Drill Tools with winch line.
- Prepare rod storage area on truck / trailer e.g., no trip or slip hazards.
- Once rod has been broken out from down the hole string; Assistant #1 who is on the drill platform passes rod to Assistant #2 then guides the rod into position with the aid of a controlled lowering of the rod by the driller, as this process is performed, Assistant #1 stand to the side away from the fall zone of the rod, Assistant #2 ensures they are never under suspended load while the rod is lowering.
- Personnel to ensure when up on truck / trailer guard rails and ladders must be in place.
- When storing rods on stand or bolster ensure stands / bolsters are level to avoid stands from falling over.
- Assistant #2 runs rod out as Assistant #1 steadies stand as the driller lowers into position.

6 BREAK OUT PIPES AND CHANGE SUBS

6.1 Potential Hazards

Potential hazards associated with drill rig set-up and pack up could include, but not limited to:

- Entanglement
- Lifting Equipment failure
- Uncontrolled movement
- Rotating Parts
- Pinch points / crush
- Inadequate PPE
- Falling objects

6.2 Support Drill String in Hole

- Ensure personnel have no loose clothing to avoid any entanglement in rotating parts.
- Swing barrier safeguard / spin cage away from working / rotary table or remove completely.
- Place rod spanner / skillet onto drill pipe.
- Lower rod spanner / skillet to rest in the rotary / working table.
- Lowering of drill string into table to be performed in a controlled manner to avoid excessive speed.
- The rod spanner / skillet must be grasped by its handles only.
- Use closed fist method, keeping fingers away from pinch points.
- Positive communications between personnel, ensuring staff are familiar with correct procedures.
- PPE, (Gloves) in accordance with VUL-SOP-065-PPE.

6.3 Apply Break-Out Tongs / Stilsons, Wrap-Spans

- Swing the break-out tong / stilsons, span wraps into position around pipe to be broken out.
- Ensure all PPE requirements between personnel are adequate. Ensure personnel have no loose clothing to avoid any entanglement in rotating parts in accordance with VUL-SOP-065-PPE
- Couple up the tong / stilsons, span wraps for damage before engaging rotation and Driller to ensure
- they are about to engage correct lever.



6.4 Break Out Pipe

- Driller activates the break-out function until thread is loose enough to be unscrewed by hand.
- Hydraulic stilsons ram should be closed when reversing.
- Beware of any flying particles while in rotation, hands well away while rotating
- Rods may be excessively torqued up, if rods are locked up, any people not directly involved in the procedure should stand away from the 'NO GO ZONE.'
- If the drill pipe threads are tight and are unable to be broken out via the conventional method, a JHA must be completed.
- Continue rotation until thread disengages, once complete disengage the rotation control.
- Stand well away from rotating parts, have long hair tied up under helmets so cannot be caught in any moving parts.
- Watch break-out function until thread is disengaged, communicate when thread is free, and assistant can unscrew pipe / rods by hand.

6.5 Remove Broken Out Pipe

- Once broken pipe is completely undone driller slowly lifts the rod out of the tool joint making sure thread does not catch and lift down hole string.
- If pipe is completely undone and by lifting pipe slowly, unexpected movement of the detaching drill rod from the string while using the haul winch will also be minimized, reducing the chance of a crush injury.
- Follow further steps below to eliminate crush injury.
 - Take weight of rod with haul winch and ensure rod has totally detached from drill string before lifting.
 - Assistant is to stand back and remove hands from rod, to indicate rod has been totally unscrewed.
 - Driller will then commence lifting slowly when totally detached, pausing until Assistant has gained complete control of drill rod.
- Raise pipe away from the rotary / working table and place rod in appropriate position.
- Assistant to ensure the rod is held approximately 150mm above tool joint to avoid pinch injury. Wear PPE (Gloves) in accordance with VUL-SOP-065-PPE.
- To Replace Drive Sub, Clear Work Area Beneath Table, if Required.

6.6 Lower Head into Position

- Operate controls to lower Head to a height sufficient to access gear selector. Remove spin guard if required to avoid pinch / crush injuries between guard and head.
- Engage low gear on the drive gearbox. Rotate slowly to ensure correct gear selection, stand clear.
- Raise Head to required location for break out stilsons to be fitted to bottom of drive sub. Watch stilsons do not slip, engage slowly, and stand clear.

6.7 Position Break Out Stilsons / Wrap-Spans

- Engage reverse rotation to break thread.



- Remove stilsons from drive sub and return to standby position.
- Engage sliding head control to position drive sub a right-hand side of table.
- Lower head so drive sub is at safe working height above table.
- Ensure sub cannot fall on any worker or fall down open hole, cover hole if required.
- Manually uncouple drive sub from the head.
- Follow VUL-SOP-096(b)-Manual Handling Tasks & Ergonomics.
- PPE in accordance with VUL-SOP-065-PPE.

7 MANOEUVRE DRILL TOOLS WITH WINCH LINE

7.1 Potential Hazards

Potential hazards associated with drill rig set-up and pack up could include, but not limited to:

- Pinch points
- Uncontrolled movement
- Poor housekeeping
- Entanglement
- Caught between
- Lifting equipment failure

7.2 Attach Sand Line / Haul Line to Drill Tool

- Ensure all appropriate PPE is worn (Gloves). VUL-SOP-065-PPE and VUL-SOP-096(b)-Manual Handling Tasks & Ergonomics.
- Positive communication between crew when running out sand Line / Haul winch.
- Tool to be lifted should have thread end chocked up off the ground for easy access for lifting plug to be
- screwed in, ensure there is enough line to avoid unexpected movement, check for snagging or winch line failure.
- Clear pathway to and from drill tool to eliminate trip hazards.

7.3 Attach Tag Line to Drill Tool

- Before driller lifts tool, Assistant attaches tag line to bottom of drill tool. Replace damaged tag lines.
- PPE, Good Communication between driller and Assistant to indicate when read.
- Visually check winch line to ensure there is not a chance of snagging, or faulty equipment.
- Good Housekeeping, make sure pathway is clear and footing is secure when conditions are wet and muddy.

7.4 Raise and Move Drill Tool into Required Position

- Personnel performing task are to plan the route before lifting.
- Clear pathway.
- Personnel not involved are to stand clear of work area.
- Driller to take slack in sand / haul line and commence raising drill tool into position.
- Ensure there is enough line to avoid unexpected movement, check for snagging or winch line failure, also check thread for wear and that test plug is secure.
- Assistant simultaneously takes weight of drill tool on tag line, guiding tool into position.



- Driller to ensure Assistant is ready to avoid uncontrolled release of tagline.
- Ensure footing, take slowly especially in wet and muddy conditions.
- DO NOT HANDLE DRILL TOOL WITH HANDS KEEP HANDS AND FEET CLEAR OF DRILL TOOL DURING TASK.
- Driller and assistant both ensure the drill tool stays as close to the ground or work platform as possible, in the event of unexpected release of movement drill tool will go to ground quickly.
- All personnel to be clear of area between drill rig and drill tool.

7.5 Release Sandline and Tag Line as Required

- Before releasing sand line / haul line personnel are to ensure drill tool is placed in a stable position to avoid unexpected movement.
- Stand clear as driller releases weight from drill tool. Communicate before release.
- After drill is secure, the assistant can then remove the tag line.

8 EQUIPMENT MOBILISATION

8.1 Potential Hazards

Potential hazards associated with drill rig set-up and pack up could include, but not limited to:

- Uncontrolled movement
- Lifting equipment failure
- Pinch points
- Equipment breakdown
- Weather conditions
- Fatigue
- Collision with vehicles, wildlife / obstacles
- Failure to prestart equipment

8.2 Load Equipment onto Vehicles

- Use mechanical means to load equipment where possible e.g., HIAB, Forklift, or winch.
- Prestart equipment prior to use.
- Ensure operator is competent and authorised.
- Where mechanical means are not practical, adopt team lifting techniques. Use correct lifting procedures. Follow VUL-SOP-096(b)-Manual Handling Tasks & Ergonomics.
- Position the load in such a manner that the vehicle maintains adequate stability, steering and braking performance.
- Ensure vehicles are chocked during load / unload activities.
- Maintain good housekeeping standards.

8.3 Secure Load

- Choose a suitable vehicle for the size of type of load.
- Use suitable restraint equipment e.g., ratchet straps, chain tensioners.
- Visually inspect tie down straps for damage.
- Loads must be restrained to prevent movement during all expected conditions of operations.
- Lock all gates, steps, etc. into travel position.



- If necessary, for personnel to be on the truck when tying down, ensure that all guard rails in place to avoid falling of back of truck.

8.4 Inspection Before Moving

- Visually check tyres for damage, stump cuts etc.
 - Check tyre pressure.
 - Check wheel nuts.
 - Check for clean windscreen, windows, and mirrors.
 - Check condition of side lights, taillights, brake lights and indicators.
- Look for physical damage that may compromise safe operation of vehicle.
- Check that all gates, steps etc. are in travel position.
- Only remove wheel chocks when visual checks are completed, and the vehicle is ready to travel. Pre-start vehicle prior to moving.

8.5 Driving with Trailer or Load

- Maximum speed limit 100kms applicable to highway driving.
- Maximum speed limit on site is defined in VUL-SOP-076-Using Mobile Plant and local limit variations may also be indicated by signage.
- Drive to road conditions and load constraints.
- Periodically ensure that load is still secure check tie down straps / vehicle condition.
- Drive to conditions, slow down if weather and / or road conditions become hazardous.
- Positive communication with vehicles upon interaction, be mindful of wildlife while driving.
- Vehicle service history should be up to date before travelling.
- Complete a Journey Management Plan to establish periodic stops to avoid fatigue.

9 SETUP / DISCONNECT COMPRESSOR

9.1 Potential Hazards

Potential hazards associated with drill rig set-up and pack up could include, but not limited to:

- Vehicle / personnel interaction
- Overhead hazards
- Flying particles
- Stored energy
- Poor communication
- Hot hoses
- Incorrect tooling

9.2 Setup of Equipment

- Ensure site has sufficient area for parking all vehicles. Use spotters where necessary.
- Watch for overhead hazards power lines.
- Multiple compressor vehicles to be parked side by side in front of rig leaving sufficient room between units for refueling vehicles to move freely between.
- Ensure all vehicles are chocked.



- The distance between the front of the rig and rear of compressor vehicles to be sufficient to extend all hoses to near full extent minimizing trip hazards on hoses

9.3 Connect Air Hoses

- Refer to VUL-SOP-096(b)-Manual Handling Tasks & Ergonomics.
- PPE(Gloves) in accordance with VUL-SOP-065-PPE
- Position manifold in a central position between vehicles when multiple compressors in use.
- Lay out hose ensuring no loops or kinks in line. DO NOT STRAIGHTEN LOOPS OR KINKS FROM AIR HOSE WHILE COMPRESSOR IS RUNNING.
- Connect all couplings. Tighten couplings with hammer. Use only Offsiders hammer.
- All safety socks to be individually anchored or fastened to manifold. All compressor chocked and couplings tightened if necessary.
- All taps on manifold to be used, to be open and close to ensure in working order. All compressor taps to be in off position.
- Barricade hose and manifold area off to make it clear visitors not to enter area.

9.4 Commencement of Drilling

- Commence using auxiliary compressor as required.
- Match both compressors with their pressures prior to commencement of drilling.
- Ensure positive communication is obtained.
- Follow VUL-SOP-096(b)-Manual Handling Tasks & Ergonomics.

9.5 Shut Down Compressor, Disconnect High Pressure Air Lines

- Close air delivery on rig console.
- Maintain positive communication:
 - Close air delivery taps on all compressors:
 - Shut down individual compressors in accordance with manufacturer's instructions.
 - Driller to release pressure in air lines at rig console.
 - Offsider to verbally or visually confirm with the driller that the pressure has been released from
 - the air hose prior to uncoupling.
- Offsider taps the hose clamp in anticlockwise direction and unscrews. Listen for air pressure release once thread broken to ensure no residual pressure. DO NOT UNCOUPLE ANCHOR SOCKS FIRST.
- Uncouple socks from anchor point.
- Store air hose in position for travel. Stow correctly to avoid damage.