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FINAL

RISK ASSESSMENT OF THE REMOTE DRILL RIG

ELBROC MINING PRODUCTS (PTY) LTD

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GROUNDWORK CONSULTING (PTY) LTD

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1 INTRODUCTION

Elbroc Mining Products (Pty) Ltd (Elbroc) have commissioned Groundwork Consulting (Pty) Ltd to undertake an operational risk assessment on the use of the Remote Drill Rig, a remotely-operated in-stope Drill Rig for installation of roofbolts, manufactured and supplied by Elbroc.

An image of the product can be seen below. Its main function is for the drilling of holes and installation of roofbolts as in-stope permanent support; it is pneumatically operated and it is designed to be a mobile rig that can be operated by two persons that are remote from the Drill Rig during drilling and installation operations.

Figure 1. Image of Remote Drill Rig

2 FINDINGS AND RECOMMENDATIONS

After visiting the premises of Elbroc to view the product and discuss its functions, the risks involved in using the product were identified as well as the measures that need to be implemented to mitigate these risks. The key hazards that were identified and the recommended controls for risk mitigation of these hazards are given below:

2.1 KEY HAZARDS

- **Unsafe working conditions when moving Drill Rig into place at face area**

  Since the function of the Drill Rig is to facilitate permanent support installation at the face, if improper face preparation has taken place for this work to occur safely in this area, the Drill Rig operators are at risk of serious injury due to rockfalls.

- **Rockfalls during removal of Drill Rig clamping cylinders on completion of drilling/installation operations**

  The Drill Rig features one or two cylinders that are pneumatically lifted and placed against the hangingwall, providing 80kg of force for stability of the Drill Rig during drilling operations. When removing these cylinders on completion of drilling and installation, a possibility exists for smaller rocks to be dislodged that can cause injury to the operators.

- **Incorrect usage of Drill Rig**

  As the Drill Rig is powered by means of pressured air and water, incorrect usage of the rig through improper training or non-adherence to correct procedures, as set out in the risk assessment, while using rig can cause injuries to one or both of the Drill Rig operators.

2.2 RECOMMENDED CONTROLS

- Operators should perform a visual inspection of the face area to determine it has been made safe according to the mine standard before moving into area
- Drill Rig operators must be provided with the necessary personal protective equipment, e.g. gloves.
- Operators should inspect the hangingwall for any loose rock above the jacks before removing; if a loose rock is observed, the operators should inform the miner who will take the necessary action.
- Operators should operate the Drill Rig from a position underneath active permanent support by fully extending the hoses from the Control Box to the Drill Rig while maintaining some slack. This will also prevent undue stress being placed on the connections when hoses are pressurized.
- Before operating the Drill Rig, the operators should test all the hose connections, on the Drill Rig and on the control box, for a secure connection by checking the screw clamps and tightening where necessary

3 METHOD OF RISK ASSESSMENT

- Evaluate all elements to the system of the Drill Rig, the operators and the work environment to identify potential hazards that exist in the relationship of these elements during operation of the Drill Rig
- Identify possible scenarios that can lead to accidental loss as a result of these hazards and evaluate the risk of each loss scenario by establishing the likelihood and consequence of each event occurring
- To evaluate any current controls and suggest additional controls to minimize or completely eliminate the risk of an event occurring that has potential to cause injury to the operators or a delay in production

Determining the level of risk of an event or less scenario requires identifying the appropriate probability and consequence categories associated with this event and then, by combining these factors into a single value, quantifying the severity of the associated risk and ranking it according to a Risk Rating.

3.1 PROBABILITY CATEGORIES

Table 1. Probability categories	
Category	
1	Happens often
2	Quite possible
3	Could happen
4	Remotely possible
5	Extremely unlikely

3.2 CONSEQUENCE CATEGORIES

Table 2. Consequence categories	
Category	
1	Fatality/fatalities/more than one shift lost/>R500k damage
2	Reportable injury/4-8 hrs. lost/R100k – 500k damage
3	Disabling injury/2-4 hrs. lost/R50k – 100k damage
4	Treat and return injury/1 – 2 hrs. lost/R5k – 50k damage
5	No injury/less than one hour lost/less than R5k damage

3.3 RISK RATINGS

Determining the level of risk of an event or less scenario requires identifying the appropriate categories for probability and consequence and using the Risk Matrix below. The resulting Risk Ratings are ranked as follows:

Consequence \ Probability	1	2	3	4	5
1	1	2	4	7	11
2	3	5	8	12	16
3	6	9	13	17	20
4	10	14	18	21	23
5	15	19	22	24	25

Figure 2. Risk matrix

Table 3. Risk Rating	
16 – 25	Low
7 – 15	Medium
1 – 6	High

3.4 RISK ASSESSMENT

The result of the risk assessment of the Elbroc Remote Drill Rig is shown below:

TASK STEPS	POTENTIAL HAZARD	P	C	Risk	CURRENT CONTROLS	RECOMMENDED CONTROLS
1. Moving Drill Rig into position at face	Unsafe working conditions at face due to improper preparation – inadequate temporary support, barring and cleaning	3	1	4	Barring, cleaning and temporary support are done to mine standard before work takes place in face area	• Drill Rig operators must inspect conditions at the face from a position of permanent support for proper preparation • If the operators are in any way uncomfortable with the conditions at the face, they must notify their miner who will take the necessary action
	Drill Rig topples over or moves uncontrollably down stope when placed in position, causing injury to operators or another worker further down stope	2	4	14	Ensure that the Drill Rig is firmly in place before setting up rig for operation	• Operators must place the safety hook of the Drill Rig onto to an existing element of support before starting the set-up of the rig • When a hole has been drilled to completion and the roofbolt installed, before lowering the clamp cylinders the operators must place the safety hook onto an element of support close to the next hole to be drilled. • Drill Rig operators must at all times be on the up-dip side of the rig or adjacent to it on strike.
	Wheels of Drill Rig come loose from rig causing the rig to topple over and cause injury to operators	4	4	21	Before removing Drill Rig from storage area, physically check that the wheels are still firmly connected to the rig	• Daily checks after shifts and weekly checks must be completed on all stored Drill Rigs to ensure wheels have not started to come loose after extended operation
2. Setting up Drill Rig	Inadvertent extending of clamp cylinders while moving Drill Rig into position causing injury	3	3	13	Ensure that the air and water controls are closed until such time that the operator moving the Drill Rig has the rig firmly in place to begin the operation	• Only trained and competent people should operate the Drill Rig • Drill Rig operators should verbally confirm that the rig is not powered until it is firmly in place and the operator is ready to being extending clamp cylinders
	Drill Rig is not placed standing upright when operating clamp cylinders, and the cylinders cause injury or damage to equipment	3	3	13	Drill Rig must be kept in an upright position when working on the clamp cylinders and drill carriage	• Only trained and competent people should operate the Drill Rig • Operator controlling air and water lines must check that Drill Rig is upright before opening controls to the Drill Rig
	Hands placed on can cause injury when clamp cylinders are extended	3	4	18	Only one operator must be handling the frame of the Drill Rig and the operation of the clamp cylinders	• Only trained and competent people should operate the Drill Rig • During confirmation, operators must ensure that no limbs or body parts are in danger of being injured by clamp cylinders • Operator controlling movement of Drill Rig frame and clamp cylinders should at all times stand behind the rig

TASK STEPS	POTENTIAL HAZARD	P	C	Risk	CURRENT CONTROLS	RECOMMENDED CONTROLS
3. Operation of Drill Rig	Vibration from drilling operations can cause loose rock to fall from hangingwall	4	2	12	Any drilling operation is controlled from a position where permanent support is installed and active	• To ensure that operators are as far from the face as possible under permanent support while drilling is occurring, the 5m hoses should be extended as far as possible away from the face, while maintaining some slack.
	Drill Rig is not used in stope widths it is intended for and operators use hazardous methods of fitting rig to stope width	3	3	13	Ensure that the Drill Rig allocation for the various stoping widths is stored separately and properly catalogued	• The mine should mark Drill Rigs with the applicable stoping widths they must be used in • A store controller must have a list of working areas, stoping widths and the required Drill Rig and must check that all rigs leaving store is for correct area.
	Hoses on inlets and outlets not secured properly causing hoses to come off under pressure when water/air controls are opened, causing injury	4	3	17	Before removing Drill Rig from storage area, physically check all hose connections to ensure that they are tightly secured and tighten hose clamps where necessary	• Daily checks after shifts and weekly checks must be completed on all stored Drill Rigs to ensure hoses have not started to come loose after extended operation and replace components where necessary • Only the supplied couplings and fitting must be used • Only trained and competent people should operate the Drill Rig
	Leaking pipes leading to loss of performance and potentially ineffective roofbolt installations	5	2	16	Visually checks for leaking water. Listen for escaping air and use paper cloths to determines point of leak	• Operators should test movement of clamping cylinders and drill carriage and water flow before commencing any drilling operations • A weekly check should be completed of all stored Drill Rigs to ensure that the hoses and connections have not deteriorated and if replacing is necessary
	Clamp cylinders not fully extended, Drill Rig not properly secured before drilling operations	3	5	20	Operator controlling clamp cylinders must allow cylinders to extend fully to the hangingwall and continue to ensure 80kg of force has been attained	• Operator of Drill Rig must physically attempt to move rig with clamp cylinders fully extended to ensure that no movement is possible • Only trained and competent people should operate the Drill Rig
	Longer drill steel falling out of chuck, causing injury to operators	2	4	14	Operator must visually and physically check that the drill steel is secured to the Drill Rig before extending drill carriage	• Operator placing drill steel into chuck must not let go of drill steel until drill has been fully extended and it is butting against the hangingwall • Only trained and competent people should operate the Drill Rig
	Drill steel placed in chuck with the drill still on	4	3	17	Controls of the drill must be kept closed until drilling operation starts and operator must check that the chuck is stationary before inserting drill steel	• All controls should be clearly labelled to ensure that the incorrect control is not inadvertently opened • Only trained and competent people should operate the Drill Rig
	Incorrect hole collaring causing drill steel to behave hazardously during drilling operations	4	5	24	A short starter jumper must be placed in the chuck to drill a collar to the hole before using longer drill steel	• Only trained and competent people should operate the Drill Rig
	Opening air valve to begin drilling before water can cause the drill steel to become lodged into hangingwall causing potential injury and equipment damage	3	4	18	Operator must visually check that water is flowing from the top of the drill steel before opening air to being drilling	• Only trained and competent people should operate the Drill Rig

TASK STEPS	POTENTIAL HAZARD	P	C	Risk	CURRENT CONTROLS	RECOMMENDED CONTROLS
	Drilling inadvertently occurring when hole has been completed and operator moves toward Drill Rig to begin process of installing roofbolt, potentially causing injury	4	3	17	Ensure that the drill vavle is closed when not in use	• Operator with Control Box should move to the Drill Rig with the rig operator to ensure that no inadvertent opening of air control is possible
	Smaller rocks dislodged from hangingwall when clamping cylinders are lowered	4	2	12	Operators must check hangingwall and ensure that it is safe to lower clamping cylinders	• Only trained and competent people should operate the Drill Rig • If any loose rock is observed, the operators should leave the Drill Rig as is and inform the miner who will take the necessary action
4. At end of shift	Equipment still under air pressure when not in use can lead to injury or equipment damage	4	4	21	Ensure that the main air valve is closed and not in use at the end of the shift	

APPENDIX A

Elbroc Remote Drill Rig Operating Instructions

Operating Instructions

1. Transport the machine to the face where holes are to be drilled. Operate rig from supported area.

2. Remove the control box from top of rig by untying retention straps, and un-coil hoses to a safe position.

3. Make sure the hoses are not tangled, twisted or kinked.

4. Hoses not to be less than 5 m long (from machine to control box). Connect air and water hoses to manifolds, making sure all connections are clear of dirt. Ensure all safety slings are connected properly.

5. Ensure that the air and water connection points have not picked up dirt whilst being transported. Clean off with cloth or hose down.

6. Open lubricator and insert a sachet of the recommended oil used by the mine (Rock drill oil). Either Shell (orange steel lubricator) oil or Castrol (green polyurethane lubricator) rock drill oil can be used

7. Close lubricator and check that is has been firmly latched over.

8. Close all ball valves on the control box.

9. Connect air and water hoses to the machine (rig).

10. Open the air supply ensuring no one is near the machine.

11. Activate clamp cylinder up and down slowly, to test (left-hand control valve on box).

12. Place the machine in a vertical position on a clear base and clamp the rig to the hanging wall by activating the clamp valve (left-hand valve).

13. Ensure that hoses to the drill did not tangle and have enough slack.

14. Activate the drill carriage to move vertical by using the right-hand control valve slowly, checking that it does not foul or hook anywhere and then lower down again.

15. Now open valve to drill and run by lifting carriage off the footwall (right control valve). Check that lubricant is coming out of exhaust port at the base of the drill muffler. Keep running until oil can be seen on side of the drill. If no oil comes out after 5 minutes, stop and check if lubrication oil sachet is releasing oil.

16. Now activate water valve at the top of control box and check that you have strong stream of water.

17. Place a short starter jumper in the chuck of the drill and latch closed the retainer clamp.

18. Now collar a hole by opening drill and water valves and lifting carriage with right hand control valve. This must be done **carefully, do not collar off line.**

19. Get the feel of the control valve and make **sure not to stall drill.** Stop and return carriage when the drill retainer reaches the hanging wall.

20. Now release the drill retainer (if used) and replace starter jumper with a longer drill steel. Repeat the cycle.

21. Should the last jumper not fit it may be necessary to move or tilt the drill to make room. This is done by lifting the locking plate and sliding the drill to the left.

22. Install the roof-bolt to the manufacturer specification and tension.

23. Re- examines area before releasing the clamping rods.

SPECIAL NOTES:-

1. The Elbroc Drill rig **should only be held on the carry bar and nowhere else when the rig is in use. Moving parts can cause hand injury if this is not done.**

2. The rig can be transported on its wheels and **should never be placed upside down.**

3. The control box is made to follow the rig during transportation, and **should not be placed upside down.**

4. An air regulator is placed on the control box to slow down the clamping thrust, and lifting cylinder thrust – **do not remove these they are there for your own safety.**

5. To carry the Elbroc Drill rig up or down difficult inclines, the drill and control box can be separated from each other, making the unit much lighter.

6. Should the drill steel jam in the hole whilst drilling, the probable cause is misalignment. Release the clamping cylinder, line up the rig, and re-clamp, or drill in a new position.

7. To avoid the slipping movements of the clamping cylinder make sure a reasonable flat or a firm place has been cleared to seat the machine, before clamping.

8. Use the correct length drill rig is used to ensure adequate clamping force on the cylinder.

9. **Do not hammer or knock the rig with any steel objects whatsoever.** The cylinders will become dented and will not operate.

10. To store your machine after a shift, run the drill dry **(without water),** to allow the grease to flow all over the drill. Next, roll up the hose on top of the rig, and place the control box on top of the frames. Move the machine to a **safe place away from the blast and away from vehicles or scrapers. Your rig can save your life, treat it with respect and care.**

11. Look for excessive grease blowing out of the hoses, or control box, this will probably be a leak. The only places that should leak oil are the sides of the control valves, and the exhaust of the drill. **Report all other leaks or damage to your superior** or tighten **if you are competent to do so.**

APPENDIX B

Elbroc Remote Drill Rig Training Manual

Programme

Practical Component:

1) Viewing of Elbroc training video

2) Practical demonstration of the Elbroc Rig and a discussion on the safe operating procedure at training facility.

3) Practical drilling demonstrations in training centre or underground training facility.

Theoretical Component:

4) Back in training room – theory training:
   a) Basic Operating Instructions
   b) Trouble Shooting Guidelines
   c) Drill Rig Capabilities
   d) Test – written by candidate
   e) Test – model answers
   f) Planned Task Observations
   g) Operator Assessment Document
   h) Risk Assessment Document overview

Practical Training and Final Assessment:

5) Candidate taken underground and coached by the training centre staff of the mine or independent MQA registered training officer in the practical operation of the drill rig.

6) Once competent in the operation of the Elbroc drill rig, the operator will be assessed and when found competent by an accredited assessor; a certificate of competency will be issued by the training centre manager of the mine or the relevant independent MQA registered training officer.

ELBROC DRILL RIG FAULT FINDING GUIDE

PROBLEM	POSSIBLE CAUSES	TESTS	FIX-UP
General -	Not enough air	Pressure test - with drill running	Need at least 2 bar (60 psi) - preferably 6 bar (90 psi)
Any drilling problem or problem with clamping or lifting cylinders - check for adequate air and water pressure		Check for leaks	Join sections. Replace pipe if more than 5 joins in 30 m
		Check for pipe blockages	Clear blockages. Straighten kinks. Remove objects compressing pipe.
		Check for too many feeds off air manifold	Reduce number of feeds from manifold.
	Water pressure too low	Check water flow from water hose before connecting to control frame	Clear blockages and leaks in feed to rig. Change mine water filter if fitted.
		Open water valve - water must come out 150 mm from end of drill bit, with the full length of drill steel	
		Check for internal blocks: bent water tube.	Remove water tube nut and clear water tube with thin wire or replace water tube - Send out for service. Replace or turn worn copper washer.
		Check for blocked water hole in drill steel	Replace blocked drill steel.
		Check that drill steel shank matches chuck	Use correct drill steel or change chuck
		Check gap between drill steel and water tube - must be less than 15 mm	Send drill in for service to reduce gap
		Colour and appearance of flushing water - changes to muddy-looking	Stop drilling and fix water supply problem.

PROBLEM	POSSIBLE CAUSES	TESTS	FIX-UP
Drill steel jams	Not enough air	See general section: "Not enough air"	
	Water pressure too low	See general section: "Water pressure too low"	
	Machine moved while drilling	Check footwall - not on loose rock	Clean footwall
		Check that load point on clamping cylinder is ok	Send rig in for service to replace load points
		Check stoping width not too high for clamping rods	Place timber under machine - if it happens often, use larger rig.
		Check operation of clamping cylinders	Send out for service
		Check for loose bolts.	Tighten bolts
		Check for leaks in rubber hoses and fittings	Replace hose section
	Lack of lubrication of rock drill	No oil coming out of exhaust	Replace lubricator oil every day
		Check lubricator	Replace lubricator
			Ensure correct grade of oil is being used
		Check for excessive oil on control box or rig	Fix leak or replace unit/hose.
	Drill steel coupler too large for bit size	Compare bit size to coupler size - Slide coupler into drilled hole - clearance to be at least 2mm all around	Select a larger bit or smaller size coupler
	Bent drill steel	Look down the length or rotate in machine	Replace drill steel
	Worn or broken bit	Examine by eye or use bit gauge	Replace bit
	New bit NOT on starter	Check if new bit was used on No 2, 3 etc jumper	New bit MUST be on starter jumper
	Not collared straight	Check drill steel parallel to clamping rod - side and front	Lower clamps and re-clamp or re-collar hole
		Check length of starter steel - should be short	Use short (300 mm) starter steel

PROBLEM	POSSIBLE CAUSES	TESTS	FIX-UP
Drill will not start	Not enough air	See general section: "Not enough air"	
	Rusted inside of drill	Turn chuck anti-clockwise by hand - must move freely	Pour oil in and around the chuck - keep operating the drill.
		Look for rust on outside - probably indicates rust inside.	Pour in thin hydraulic oil or diesel
			Turn drill upside down and hit on footwall, with air on.
	Standing too long	Check for rust and/or sludge on outside	Same as above
	Not flushed properly after previous shift	Open valve - no air flow through drill	Same as above - train operators to flush properly at end of shift.
	Grit or sand in drill	Rough feeling when chuck rotated	Clean drill with water, then lubricate. If no success, Send out for service.
	Valve on drill is closed	Check position of machine valve handle	Put valve in correct position - tie into upright position with wire.
	Drill valve stuck	Valve handle rotates complete circle	Turn the valve with pliers
	Internal air valve stuck	Drill does not fire when air valve opened - release of air.	Turn drill upside down and hit on footwall, with air on.
	Breakages inside drill	Chuck can rotate in both directions	Send out for service
		Drill fires but does not turn - rifle nut faulty	
	Bent water tube or water tube end crimped closed	Look at water tube	Try to straighten or open end. Replace water tube. Check that drill steel shank is not too long for chuck - possible wrong drill steel or rubber collar has slipped.
		Check that water comes through	
	Faulty valve on control frame	Check that the valve handle turns the valve	Re-tighten handle on valve. If not possible, replace valve.
	Excessive wear inside drill	Check wear on chuck bush - will indicate internal wear state	Send out for service.

PROBLEM	POSSIBLE CAUSES	TESTS	FIX-UP
Clamping cylinder does not clamp or release	Not enough air	See general section: "Not enough air"	
	Seals and O-rings	Check movement of rod - jerky or does not move all the way	Send out for service
		Check air leaks.	
	Bent rod	Check straightness when extended	Correct small bend for 1 shift by pulling straight. Send out for service.
		Pull the rod out - it will become tight	
	Air leak from rubber hoses	Look for air leak - oil accumulation and sound of air.	Fix if competent. Send out for service
Telescopic air leg does not operate	Not enough air	See general section: "Not enough air"	
	Seals and O-rings	Check movement of cylinder- does not move all the way	Send out for service
		Check air leaks on seals	
	Bent rod	Check straightness when extended	Send out for service.
		Pull the rod out - it will become tight	
	Damaged telescopic cylinder	Check for dents.	Send out for service
		Cylinder will move then jam.	
		Drill is not lifted or drops by itself.	
	Air leak from hoses	Look for air leak - oil accumulation and sound of air.	Fix if competent. Send out for service
Lifting system does not operate	Not enough air	See general section: "Not enough air"	
	Faulty rotary valve on control frame	Excessive oil or visible air leak	Replace O-rings if competent, or send out for service
	Seals and O-rings	Check movement of clamping rod - does not move all the way	Send out for service
		Check air leaks from gland.	
	Bent rod	Check straightness when extended	Send out for service.
		Pull the rod out - it will become tight	

PROBLEM	POSSIBLE CAUSES	TESTS	FIX-UP
Penetration is slow	Not enough air	See general section: "Not enough air"	
	Water pressure too low	See general section: "Water pressure too low"	
	Worn bit	Check with gauge	Replace bit
		Inspect for missing buttons	
	Wrong chuck size	Check that drill steel shank length matches chuck	Replace drill steel or drill
	Slipped collar	Compare two drill steels or measure: 108 or 159 mm	Replace drill steel
	Wrong bit selection	Check correct bit size	Contact bit supplier
		Rapid chipping or wear of carbide	
		Check bit taper matches taper of drill steel	
	Loss of water on couplings	Water coming out of couplings	Replace worn couplings
	Too much friction on drill steels	Check diameter of couplings	Use small couplings or larger bit or 1-2-3 drill steel system
		Check straightness of drill steel	Replace drill steel
		Check alignment of machine	See "Drill steel jams"
			Use short starter jumper
		Check excessive wear on drill steel	Applicable only to 28 mm bit - replace
	Low thrust from lifting cylinder - eg seals worn	Push down on drill with lifting air open - if force feels "soft" (less than 80 kg)	See "Lifting system does not operate"
	Faulty drill	See "Drill steel jams" or "Drill will not start"	See "Drill steel Jams" or "Drill will not start"
	Too many drill couplings	Analyse drill steel lengths - see of they can be reduced by using longer steels	Use longest possible drill steels for the situation.
	Drilling into steel	Penetration suddenly stops	Move hole

		Bit shows damage	
		Look around for rock bolts nearby.	
		Drill frame moves	
	Drilling into a broken rock	Look at angle of fractures	Move hole 150 mm backwards
		Small rock pieces in water flushing	
		Water coming out of fractures	
		Drill steel suddenly jams and cannot be removed	
		Drill "jumps" suddenly	
		Listen to changed drilled sound	
	Rock very tough	Collaring jumper jumps around	Contact bit supplier
	Excessive weight of drill string	Check size of drill steel - 25 mm steel will give excessive weight	Use only 22 mm hex drill steel
	Worn hexagonal couplers	Check condition of hexagonal sockets	Replace couplers
	Excessive drill thrust	Listen to hammering sound or watch chatter of the chuck bush on drill collar	Reduce thrust with rotary value until best penetration rate is achieved.
	Mismatching drill bits	Check bits on drill steels - all must have same number and pattern of buttons	Use same supplier and bit pattern on all bits.
		Pull the rod out - it will become tight	

PROBLEM	POSSIBLE CAUSES	TESTS	FIX-UP
Abuse damage	Blasted-on	Dents on all parts. Cuts in hoses. Broken fittings	Move away from working face and store in safe place..
	Run-over/crushed	Bent cylinders and crash bars.	Store in safe place away from vehicles. Barricade off working areas.
	Tipped/dropped in transport	Frame distorted and/or buckled wheels	Use proper procedures and equipment for transport
	Unsafe storage location	See "Blasted-on" or "Run-over/crushed"	Store in safe place away from moving machinery.
	Hoses not properly coiled and stowed.	Twisted and kinked hoses	Properly coil and secure hoses.

ELBROC DRILL RIG height capabilities

Rig Size	Minimum SW Clamping	Maximum Clamping
750	800	1.25M
1M	1.2M	1.9M
1.3M	1.5M	2.5M
1.7M	1.9M	3.3M

ELBROC DRILL RIG weight specifications

Rig Size	Mass excl. Rock drill, Incl. Control box (Kg)	Mass incl. Rock drill, Incl. Control box	Mass of control box incl. Valves (Kg)
750	39	62	6.5
1M	42	65	6.5
1.3M	49	72	6.5
1.7M	52	75	6.5

ELBROC DRILL RIG ACCESSORIES

ELBROC Rig Masses (Kg)

Rig Size	Mass (w/control frame) Kg. Drill excluded
750	39
1M	42
1.3M	49
1.7M	52

Various Drill Masses (Kg)

Compair Short LP muffled	24.5
Compair Long unmuffled	22.5
Compair Long muffled	25.0
Boart 215 short muffled	18.5
Boart 215 long muffled	24.0
Boart S25 Long muffled	28.5
Boar Long muffled	29.0

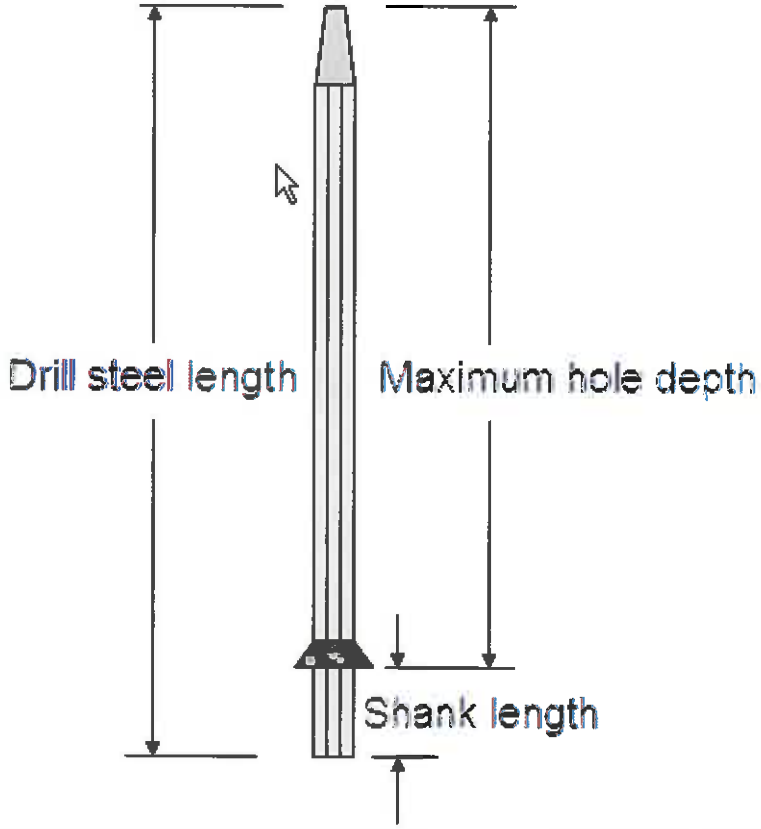
Couplers

R22 couplers are 31 mm diameter		
R25 couplers are 35 mm diameter.		
Both lose 70 mm per joint		
Sandvik couplers are 33 mm diameter		

Drills

(1)	Compair or Boart short chuck, LP base		
(2)	Compair or Boart long chuck, std base		
(3)	Boart S25 long chuck, w/handle; Boar		

Drill steel lengths



Maximum hole depth = drill steel length – shank length

Shank lengths

Short chuck drill: 108 mm

Long chuck drill: 159 mm

Maximum drill steel length = stoping width – 30 mm

ELBROC DRILL RIG TEST

Test for an operator on Elbroc Remote Drill Roof Bolter

Personal Details:-

Name & Surname:	
I.D. Number:	
Section:	
Date:	

ANSWER THE FOLLOWING QUESTIONS IN THE SPACE PROVIDED:-

Questions:	Answers:-	**MARK**
1. What PPE should be worn?		
2. Where does the air hose get attached?		
3. Where does the water hose get attached?		
4. Which oil should be used?		
5. How often should the oil be checked?		
6. What should be done before the airline hose is connected to the control box?		
7. Where should the operator sit whilst operating the Elbroc rig?		

continue…

Questions:	Answers:-	MARK
8. How should the site be prepared before clamping the rig?		
9. What should you see at the exhaust of the drill before clamping the rig?		
10. Where can a person safely hold the rig when moving the rig?		
11. What size jumper is used for collaring?		
12. What do you do if the drill steel does not fit into the hole because the drill steel is longer than the space between the drill and the hang?		
13. What is the control valve on the machine frame for?		
14. What does the right hand control valve on the control box do?		
15. How can the rig be made lighter to carry?		

Continue...

Questions:	Answers:-	MARK
16. What causes the drill steel to jam in the hole (3) causes?		
17. How can you release the drill steel?		
18. What causes the clamping cylinder to move?		
19. What should you do to the drill at the end of a shift?		
20. Where should the control box be placed when you are ready to move the rig?		
21. Where should the rig be stored after a shift?		
22. Where only SHOULD the oil be seen coming out of your rig?		
23. What do you do if you find other places where the oil is leaking from?		
	TOTAL SCORE:	

Candidate's signature .....

Assessor's signature .....

Elbroc Test Answers

Answer sheet for an operator test on the Elbroc Remote Drill Roof Bolter

Questions:	Answers:-
1. What PPE should be worn?	**Overalls, gloves, ear protection, mine safety hat, and boots.**
2. Where does the air hose get attached?	**Onto the lubricator.**
3. Where does the water hose get attached?	**Onto the water valve on top of the control box.**
4. Which oil should be used?	**Standard rock drill lubrication oil only.**
5. How often should the oil be checked?	**Check before starting your panel and if oil does not come out of the drill exhaust.**
6. What should be done before the airline is connected to the control box?	**Shut off all control box valves and keep everyone clear from the rig.**
7. Where should the operator sit?	**In a safe place under permanent support.**

continue...

Questions:	Answers:-
8. How should the site be prepared before clamping the rig?	**Clean and level the area to place the base of the rig and ensure that the hanging wall is made safe according to your mine standard before placing the rig in position.**
9. What should you see at the exhaust of the drill before clamping the rig?	**Oil should be seen.**
10. Where can a person safely hold the rig when moving the rig?	**Only on the frame handle.**
11. What size jumper is used to collar?	**A short starter jumper.**
12. What do you do if the drill steel does not fit into the hole because the drill steel is longer than the space between the drill and the hang?	**The drill can be tilted away once the secure pin has been removed.**
13. What does the control valve on the machine frame do?	**Used for clamping the clamping rod.**
14. What does the right hand control valve on the control box do?	**The right hand control is for operating the telescopic air leg.**
15. How can the rig be made lighter to carry?	**The drill and control box can be removed from the rig to make it lighter.**

Continue...

Questions:	Answers:-
16. What causes the drills to jam in the hole (3) causes?	**1. The collaring was not straight.** **2. The rig moved while drilling.** **3. The drill did not get enough or any water.**
17. How can you release the drill steel?	**The clamping cylinders can be released and re-clamped.**
18. What causes the clamping cylinder to move?	**The clamping cylinders move if the base was not well positioned.**
19. What should you do to the drill at the end of a shift?	**The drill should be run dry (without water) for a few minutes to allow oil to protect the inside of the drill.**
20. Where should the control box be placed when you are ready to move the rig?	**The control box should be placed on top of the rig.**
21. Where should the rig be stored after a shift?	**In a safe, dry place away from the blast from scrapers and machines.**
22. Where only SHOULD the oil be seen coming out of your rig?	**Only from the exhaust of the drill.**
26. What do you do if you find other places where the oil is leaking from?	**Report the damage or leak to your superior or fix, or tighten if you are competent to do so.**

ELBROC DRILL RIG PLANNED TASK OBSERVATION

PLANNED TASK OBSERVATION:-

MINE:							
SHAFT:							
NAME:				**COY NO:**			
SECTION:				**DATE:**			
NOVICE		**EX LEAVE**		**EX OTHER MINE**		**ROUTINE**	

A Planned Task Observation has been done on the above employee

No.	Roof Bolt Hole Drilling	Results		Re-trained	Date
		YES	NO		
1.	Did he adhere to the PPE that he needs for the job?				
2.	Did he adhere to the PPC?				
3.	Did he search & make the area safe?				
4.	Did he drag & move the machine carefully?				
5..	Did the operator make sure that he area is declared safe by an authoirised mine personel?				

Continue...

No.	Roof Bolt Hole Drilling	Results		Re-trained	Date
		YES	NO		
6.	Did he remove the control box & check that the hoses were not twisted or kinked?				
7.	Did he place the control box in a safe place to sit while operating the rig?				
8.	Did he check the lubricator & oil supply?				
9.	Did he test the air supply & correctly connect it?				
10.	Did he close all the control valves first?				
11.	Did he correctly connect & test the water supply?				
12.	Did he check that nobody was near the rig when he opened the air supply?				
13.	Did he clamp the rig on a fairly clean base & at the correct place to drill the hole?				
14.	Did he test the telescopic air leg to ensure the drill can move up & down freely without the hoses fowling to hooking anywhere, & that they have enough slack?				
15.	Did he check that the drill runs correctly, & that oil runs out of the exhaust?				
16.	Did he put a short collaring jumper in the chuck?				
17.	Did he collar carefully & not off-Ine (other than 90deg to the hanging)				
18.	Does the drill rotate efficiently & not stall or bounce unnecessarily?				

No.	Roof Bolt Hole Drilling	Results		Re-trained	Date
		YES	NO		
19.	Can he change the drill steels efficiently?				
20.	Did he work in a safe manner?				
21.	Did he move the machine to the next place in a safe & efficient way?				
22.	Did he clean the rig when he was finished with his task?				
23.	Did he pack up the rig correctly with the control box on top?				
24.	Did he tie the loose hoses to the frame?				
25.	Did he place the rig in a safe, dry place away from moving machines, electric equipment or scrapers & far away from the blasting area?				
26.	Did he work in a safe manner, to himself, his fellow workers, & the equipment?				

SUPERVISOR:	
NAME:	
COY NO:	
SIGNATURE:	

ELBROC DRILL RIG ASSESSMENT

INSTOPE ROOF-BOLT TRAINING PROGRAM

ELBROC DRILL RIG OPERATOR ASSESSMENT

NAME:		**I.D.NO.**	
SURNAME:		**COY NO.**	
DATE:			

ASSESSMENT ON RIG: _____ **RIG NUMBER:**

SO1	**PRE-DRILL INSPECTION**			
A	**EQUIPMENT**	**YES**	**NO**	**REMARKS**
	P.P.E. MUST BE CHECKED AND WORN!			
	1. Drill-steel			
	2. Drill-bits			
	3. Hoses			
	4. Air and water couplers			

B	**VISUALLY INSPECT RIG**	YES	NO	REMARKS
	1. Frame			
	2. Clamping cylinder			
	3. Telescopic air leg			
	4. Drill clamping pin			
	5. Control valve – clamping rod			
C	**VISUALLY INSPECT CONTROL**	YES	NO	REMARKS
	1. Frame			
	2. Main air inlet valve			
	3. Water inlet valve			
	4. Telescopic control valve			
	5. Drill operating control Valve			
	6. Water valve			

SO2	CONNECTION OF HOSES & PHYSICAL INSPECTION OF RIG			
A	**CONNECTION OF AIR HOSE**	YES	NO	REMARKS
	1. Check valve on manifold			
	2. Fasten hose to manifold			
	3. Open air & blow out hose			
	4. Close valve & fasten hose to air control valve on control box			

B	**CONNECTION OF WATER HOSE**	YES	NO	REMARKS
	1. Check valve on manifold			
	2. Fasten hose to manifold			
	3. Open water & wash out hose			
	4. Close valve & fasten hose to water control valve on the control box			
C	**INSERT LUBRICATION**	YES	NO	REMARKS
	1. Fill lubricator daily			
	2. Close lubricator & secure properly			
D	**TEST CONTROL & RIG MOVEMENT**	YES	NO	REMARKS
	1. Open clamping rod control valve & check function.			
	2. Open drill operating control valve & observe performance.			
	3. Insert drill-steel into chuck of the drill & open water valve to check water flow through machine.			
	4. Open & close main inlet valve to check that air can be shut in case of emergency.			

	DRILLING OF THE ROOF-BOLT HOLES			
A	**SETTING UP THE RIG**	YES	NO	REMARKS
	1. Move rig to top of panel (first hole)			
	2. Hold rig to 90° to hanging wall dip			
	3. Open stabilizing outrigger valve to secure rig to hanging wall.			
	4. Put first drill-steel in chuck of machine			
	5. Move away from rig with the control			

B	DRILLING OF HOLES	YES	NO	REMARKS
	1. Open drill control valve slightly for collaring until drill-bit has entered rock			
	2. Open water valve			
	3. Open drill control valve fully and drill starter drill-steel completely.			
	4.Close water valve and lower the drill			
	5. Swap starter drill-steel with 1meter (or as specified) drill steel by using swivelling device on rig			
	6. Move away from rig back to control under supported area			
	7. Complete drilling of support hole			

SO5	INSTALLATION OF ROOFBOLTS

Install roof support as specified by the Rock Engineering Department

SO6	REMOVE DRILLING & EQUIPMENT FROM FACE			
A	SAFE AREA TO STORE RIG & EQUIPMENT	YES	NO	REMARKS
	1. Out of blasting area behind blasting barricade.			
	2. Not behind a joint of the blasting barricade.			
	3. Not in the travelling way			
	4. Out of the way of scraper & scraper rope movement			
	5. Move to second panel when first panel has been completed & equipment has been stored in a safe area.			

The above mentioned trainee has been found:

COMPETENT ☐ **INCOMPETENT** ☐

RECOMMENDATION AND COMMENTS:

	NAME:	SIGNATURE:
TRAINEE:		
INSTRUCTOR:		
ASSESSOR:		
PROJECT LEADER:		