



Risk assessment

on the

Jackpot

Terramac Pre-stressing System

This Risk assessment has been prepared by New Concept Mining (Pty) Ltd.
as required by the Mine Health and Safety Act

23/08/1999 (Up dated – 23/08/2001)
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Section 1 Summary

Introduction

In order to compile this risk assessment guide on the installation and the operation of the **Terramac Elongate Pre-stressing Device**, nominated members of **New Concept Mining (Pty) Ltd** met, and agreed on the Risk assessment objective and approach. A team was formed to facilitate and develop the Jackpot risk assessment.

Note. This Risk Assessment has been prepared so as to include all the current range of Jackpots namely, JP140, JP160, JP175S, JP190S, JP190, JP190R, JP220S, JP220 and JP260. (These are the dished range of units). The reason for including them in the same assessment is because the features, precautions, risks etc are the same for one and all and here after are referred to as the Pre-stressing device in the Risk Assessment.

Special note should be made of a number of issues that have arisen in recent times. These issues are discussed now as they have only now been experienced or realised as our and the users experience in the use of Jackpots increases. It should also be noted that events have occurred out of the underground mining environment to prompt us to include them in the Risk Assessment. Some of these have happened on mine property and others in adjacent residential areas. None the less all have had an impact on the mining community.

1. Re-pumping of the previous line of pre-stressed elongates has proved successful in limiting blast out rates in the second and third line of support. This is due to load loss due to the system creeping.
2. Units, which lie unused underground, are subjected to humid conditions and will rust. Rust is not a problem when the unit is installed because of the rate of mining but units that are used after a lengthy period of time may have begun rusting on the inside. These rust flakes could come loose during inflation and snag the valve causing leakages. This is a waste of money and is also dangerous as the support is no longer under load.
3. Salvaged used units should not be reshaped for reuse. Pots that have not been used at all and are visibly undamaged and have been brought to surface may be sent back to a panel for use.
4. Salvaged units should be punctured by means of a spike, **never use heat** they will explode when the water in them turns to steam.
5. These devices should not be used for cooking in. They could explode when the water in them turns to steam. **These explosions are violent and could cause serious injury and even death.**
6. Care should be taken when salvaged timber is used for firewood that there are no PSDs attached that could explode when burned.
7. NCM have introduced a new product into the market place, namely the Hydrabolt. This new product requires a new high-pressure pump to install the bolt underground (minimum 20mpa). This new high-pressure pump can be used to install Jackpots as long as the correct Jackpot nozzle is used which relieves at 12Mpa. **If the incorrect nozzle is used the devices could explode causing serious injury and even death.**

While every effort is made to adequately train new users in the safe use of the Terramac Pre-stressing device this can only be achieved if the supervisors enforce the correct installation procedures on a daily basis. NCM staff also conducts regular follow up visits.

Section 2 – Objectives

The objectives of the risk assessment are as follows:

Operational Risk Analysis

To identify the hazards, prioritise the risks associated, and highlight the controls required to eliminate/minimise the risks related to the **Terramac Elongate Pre-stressing Device** and its operation, as well as any risk of failure, primarily from the point of view of the health and safety of the workforce, but also production delay and asset damage and /or a combination of the three.

Section 3 - Risk analysis method

The risk analysis followed two accepted methods. All risk analyses follow a general scheme that can be described as follows:

- Describe the system under analysis (including equipment, personnel, procedures, work environment, management and supervisory systems etc.).
- Identify loss scenarios (i.e. sequences of events leading up to potential or actual losses i.e. incidents or accidents) in the form of hazards, potential productivity interruptions, asset damage events, environmental issues etc.
- Evaluate the risks of each loss scenario by determining the relative likelihood of each event, and the relative consequence of each event.
- Evaluate the currently planned controls, barriers and safeguards.
- Identify additional, potential controls, barriers and safeguards.

In the current exercise, a select team from **New Concept Mining (Pty) Ltd** accomplished these steps:

Define the operational system

The exercise was scoped to review risks related to the work process from Transport into Stope Blasting to minimise loss to the workforce. An operational flow chart highlighting mining activities during operational use was derived. In addition, the equipment was broken down into component parts, within the flow chart.

Identify the possible system hazards

This step postulated the maximum reasonable consequence of loss scenarios or failures (i.e. of circumstances leading up to or resulting in hazards). The consequences were classified as losses to people (Health & Safety) in this instance. In the second instance, the effect of the failure was highlighted.

Determine the level of risks

Risks associated with each step in the operational process were considered. This is achieved by considering the event frequency or probability, and the event severity or consequence.

The ranking system used is described below:

Risk is defined as the product of **probability** and **consequence**.

Probability categories

Probability categories were defined as follows.

A = Common

B = Has Happened

C = Could Happen

D = Not Likely

E = Practically Impossible

Consequence categories

Consequence categories were defined for health and safety.

	Health & Safety
1	Fatality / Permanent disability
2	Reportable Injury
3	Disabling Injury
4	Dressing Station Case
5	Self Treated

Risk categories

Risk categories were defined by combining the probability and consequence categories above according to a matrix of prioritised risk ranking as follows.

		Probability				
		A	B	C	D	E
Consequence Category	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

A risk score of 1 denotes the highest (most significant) risk; and a risk score of 25 denotes the lowest (least significant) risk. **In the current exercise, all losses and failure were considered severe, and therefore all hazards were examined.**

Define and describe the system controls and barriers

This step identified existing controls and barriers, and also considered, planned, and possible additional controls and barriers, which could be used to manage the operational risk. Controls and barriers include engineering devices, operational methods and practice, management action and principles and environmental and system amendments that the team agrees appropriate to consider.

Assess the adequacy of the controls

The adequacy of the nominated controls in terms of design devices, management and operational practices and system amendments was reviewed by the team to ensure that additional scope for risk reduction has not been

overlooked within the time available. If the controls are considered inadequate, recommendations to improve the situation are made. The test team bearing in mind cost-benefit

Document the study process and results

The report is presented so that the company can review the planned and proposed controls and barriers and can devise an implementation plan to incorporate additional approved controls established through the risk analysis.

Analysis logistics

The risk analysis was conducted over one day being the 10th June 2005 at **New Concept Mining (Pty) Ltd** offices with a selected risk review team participating in the exercise. Participants are listed below:

<i>Section/Position</i>	<i>Name</i>
1. Managing Director.....	Paul McKelvey B.Sc. MSc (Mech. Eng.).....
2. Manager.....	Nick Marvin B.Sc.(Min.Eng.).....
3. Manager.....	Owen McMahon.....
4. Technical Support + Safety.....	Simon Mangena.....
5. Area Sales Manager.....	Errol Wilson.....
6. Manufacture.....	Greg La Vita
7.
8.

Section 4 - Installation Procedure

1. Timber poles are supplied to the mine complete with the Jackpot assembled to the mine pole. Before installing the Terramac, clear the hanging wall of loose rock and prepare a solid, even surface.
2. Measure and mark for the poles on the hanging wall according to your mine standards.
3. Make sure that the marks for the poles are in a straight line.
4. Clear the foot wall of broken rock and prepare a solid surface.
5. Using two sticks measure the distance between the hanging wall and the foot wall. Use a hammer to make sure you measure 90 degrees to the hanging wall.
6. Cut the pole, at the other end to the Jackpot, exactly to your measurement. A straight cut will reduce the amount of pumping required.
7. Hammer the Terramac into position at 90 degrees to the hanging wall.

8. Installation using Jackpot Safety Pistol and Air Pump

- Check the relieving pressure daily
- Clean the Jackpot valve, if required, with water from the Jackpot nozzle and pump
- Attach the nozzle to the Jackpot
- From a safe position pump water into the Jackpot using the safety Pistol and air pump, when the correct pressure is reached water will squirt out of the relief valve.
- Remove the nozzle from the pumped Jackpot.

9. Installation using Jackpot Hand Pump

- Pumps are preset during manufacture but the relieving pressure should be checked
- Clean the Jackpot valve, if required.
- Attach the nozzle to the Jackpot.
- From a safe position pump water into the Jackpot using the hand pump. When the correct pressure is reached water will squirt out of the relief valve.
- Remove the nozzle from the pumped Jackpot.

10. Installation using extension nozzle

- Check the relieving pressure daily
 - Clean the Jackpot valve, if required, with water from the Jackpot nozzle and pump
 - Attach the extension nozzle to the Jackpot
 - From a safe position pump water into the Jackpot using the safety Pistol and air pump, when the correct pressure is reached water will squirt out of the relief valve.
 - Remove the extension nozzle from a safe distance.
11. When looking at the installed props from the top of the panel, only one stick should be visible; (all in a straight line). The blast barricade can now be fitted.

Safety Tips and Hints

- **For safety reasons the pressure relief valves on the pistol and hand pump must not be tampered with. These are factory set to the required mine standard.**
(The relief pressure can be checked underground by connecting the Jackpot pressure gauge.)
- **Where the pump or pistol does not relieve at the correct pressure it should be sent to surface for a service.**
- **Always position yourself in a supported area when installing Terramacs.**
- **Always make sure you are wearing gloves and safety goggles when installing Terramacs.**
- **The sticks should be measured and cut accurately and hammered into position for best results. (before inflating Jackpot)**
- **Check the relieving pressure daily**

Section 4 - results

The risk analysis exercise generated a structure set of results presented in this section.

Results

Results are presented overleaf in the following sequence.

- Risk analysis tables.

Jackpot Elongate Support System

STEP	POTENTIAL ACCIDENT	Without controls			With controls			ISSUES	
		Probability	Consequence	Rank	Probability	Consequence	Rank		
1. Timber selection	Stick failing leading to FOG accident	A	1	1	QA by supplier	D	1	7	Timber specially selected for: 1) Species 2) Diameter 3) Straightness 4) Knots 5) Specific gravity
2. Timber Processing	Timber fails at insufficient load	A	1	1	QA by supplier	C	1	4	Timber correctly processed including the following operations: 1) Felling 2) De-barking 3) Curing 4) Cross cutting 5) Turning 6) Strapping 7) Fire treatment if required
3. Jackpot Manufacture	Failure leading to pressure loss and stick falling out and FOG injury to people.	A	1	1	1) Ordering correct materials including steel specification. 2) Check material batch chemical analysis certificates 3) Quality Acceptance testing on all material and components 4) Air pressure testing of all completed units for leak detection. 5) High Pressure test of 5% of completed units to 15Mpa	D	1	7	Correct QA procedures for: 1) Steel Procurement 2) Fabrication 3) Testing
4. Mine timber yard	Injury due to material handing and props falling	B	2	5	1) PPE supplied (hard hat, boots, gloves) 2) Training	D	4	21	1) Handling 2) Stacking height 3) Strapping

	Timber degradation causing failure at insufficient load due to excessive drying and hence splitting	B	1	2	1) Mine stores or 2) Supplier in the case of Mine Yard Management	C	1	4	Correct: 1) Stock Rotation 2) Stock Levels
5. Transport into stope	Worker drops unit causing injury	B	2	5	1) Training 2) PPE (boots, gloves, hard hat)	B	4	14	1) Use mono rope where possible, (see RA on mono-rope installation and operation) 2) Carry straps to be provided 3) PPE supplied by mine (Hard hat, gloves, boots) 4) Carry, do not throw
	Rolling material causing injury	A	2	3	Training and Supervision	B	2	5	1) Stack correctly in stope storage areas
	Bundle falling apart when straps are cut in cross-cut causing injury	A	2	3	Training and Supervision, Mine Standards on stacking	C	4	18	2) Use cars with sides.
	Unit falls off mono rope or is dropped leading to injury (steep areas)	A	2	3	Training and Supervision, Mine Standards	C	2	8	1) Gate stulls. 2) Mine standards for steep areas apply.
	Slip and fall leading to injury	B	3	9	1) Mine Standards 2) PPE issued (hard hat, gloves, boots)	C	4	18	1) Area >35-degree steep area, safety belts needed. 2) Good house keeping. 3) Gate stulls. 4) Mine procedure to prevent rolling rocks
6. Storage.	Units lie around for long periods and rust from the inside causing valve failure and loss of support.	A	1	1	Units supplied in bags of 350. Underground stores available.	D	5	24	Units should be stored in dry area until required.
7. Preparation for installation	FOG injures worker	A	1	1	Mine Standard	C	1	4	1) Make safe
	Support installed at incorrect spacing causing inadequate support resistance and possible F.O.G	A	1	1	Mine Standard	C	1	4	2) Mark off positions of props on hanging wall. Support spacing as per Rock Engineering recommendation.

	Prop can blast out because it is installed on loose rock and insufficient pre-load is obtained – F.O.G and wastage of material	A	1	1	Training. Done by the supplier when introduced to the mine and follow up visits on going.	C	1	4	3) Clean footwall to solid rock
	Prop can blast out because it is installed with insufficient pre-load - F.O.G and wastage of material	A	1	1	Training: Is setting gauge and setting tool available?	C	1	4	4) Check water hose and pump (and air supply where applicable). 5) Check pressure relief valve setting on pump – (see RA on Jackpot Safety Pistol and Hand Pump).
8. Measure and cut Note: Always trim the end that does not have the Jackpot assembled to it. Never trim the end of the mine pole were the Jackpot is attached.	Timber cut to wrong length causing production delay	B	5	19	Training done by the supplier when introduced to the mine.	C	5	22	1) Measure correctly to ensure tight fit of prop against hanging wall
	Injured by bow saw	B	4	14	PPE issued by mine, (gloves, boots, hard hat) training	C	4	18	1) Training
	Prop sawn excessively skew so that Jackpot cannot accommodate misalignment – prop blasts out	A	1	1	Training is done by the supplier when device is introduced to the mine. The training centre is also trained to do follow up visits	B	1	2	1) Saw to within 20mm of straightness
9. Installing the Terramac	Knocking the hanging wall with hammer causing FOG or rock fragments leading to eye injury	B	1	2	Training and PPE (Hard hat, gloves, boots, goggles)	C	1	4	1) Make safe 1. Sound (hollow sound = danger) 2. Bar 3. Barricade 4. Warning signs
	Prop blasts out causing risk of F.O.G	A	1	1	Training by the supplier initially with follow up visits regularly.	B	1	2	2) Install at 90° to strike and dip
	Rocks fall during installation or handling causing injury	B	2	5	Training by the supplier on introduction and regular follow up visits.	B	2	5	3) No workers to work down dip of installation 4) Use gate stulls
	Prop falls out during installation	B	2	5	Training done by the supplier during introduction.	C	5	22	5) Install normal to dip. 6) Cut to slightly over-size and hammer into place
10. Remote pre-stressing using Jackpot Hand pump or Jackpot Air Pump and Safety Pistol or remote nozzle.	Prop falls during pre-loading leading to injury.	B	2	5	Training done by the supplier during introduction of product	C	3	13	1) Accurately measure and saw timber pole. 2) Knock in with hammer. 3) Remotely pre-stress with pump.

Hand Pump. Hand pump fails during installation.	B	2	5	PDI done on all units prior to delivery. Tested for leaks and relieving valve set at correct pressure.(12MPa)	C	3	13	1) Repair kits available.
Hose connector blows (nozzle) off while pumping.	C	4	18		D	3	17	1) Check all connections are free of grit prior to pumping.
Unit is over inflated causing rupture.	A	1	1	Relief valve factory set at 10-12 MPa.. Special tool required to re-set relief valve.	B	1	2	1) Use gauge supplied to test relief valve setting daily.
Hand pump fails after period under ground causing production loss.	B	1	2	Training supplied on the use of pumps. Check pumps daily for signs of wear.	C	3	13	1) Internal filter sock placed in all units to be kept clear of fines and rust.
Air Pump. (Yellow) Air pump fails during installation.	B	2	5	PDI done on all units prior to delivery. Tested for leaks and correct operation	C	3	13	1) Repair kits available
Air pump fails after period under ground causing production loss.	B	1	2	Training supplied on the use of pumps. Check pumps daily for signs of wear.				1) Internal filter socks placed in air and water supply pipes to be kept clear of fines and rust.
Safety Pistol. Setting pistol fails causing production loss.	B	2	5	PDI done on all units prior to delivery.	C	2	8	1) Repair kits available
Hose blows off when not connected correctly.	C	4	18	Training done by supplier. PPE supplied by the mine. (Goggles, hard hat, boots, gloves)	D	4	21	1) All connections to be free of grit and or staple to be correct position.
Hose blows off Jackpot while inflating causing delays.	C	4	18	Training done by supplier. PPE supplied by the mine.(goggles, hard hat, boots, gloves)	D	4	21	1) All connections are to be free of grit. 2) Nozzle to be connected correctly.
Bursting of Jackpot causing high pressure water in eyes.	B	2	5	PPE supplied by mine (gloves, hard hat, boots, goggles)	D	2	12	1) Follow correct installation procedures. 2) Wear goggles. 3) Remotely pre-stress.
Over inflation of Jackpot causing rupture.	A	1	1	Training. Safety pistol factory set to 10-12mpa to prevent over inflation. Special tool required to adjust relief valve.	B	1	2	1) Wear PPE supplied by the mine. (Goggles, hard hat, boots, gloves) 2) Use gauge supplied to check pressure relief daily
Struck by hose while under pressure.	C	4	8	Training given by supplier.	C	4	8	1) Attach hoses securely.

<p>Note: Re-Pumping the previous shifts poles improves the support systems blast resistance and over comes any load loss that may have occurred.</p> <p>Note: Always release the Safety Pistol handle before removing the nozzle from the PSU, this relieves the pressure in the pipe and prevents injury</p>	<p>High Pressure Air Pump (Blue). Retrofit (Blue & Yellow) Air pump fails during installation.</p>	B	2	5	PDI done on all units prior to delivery. Tested for leaks and correct operation	C	3	13	1) Repair kits available
	<p>Air pump fails after period under ground causing production loss.</p>	B	1	2	Training supplied on the use of pumps. Check pumps daily for signs of wear.				1) Internal filter socks placed in air and water supply pipes to be kept clear of fines and rust.
	<p>Safety Pistol. Setting pistol fails causing production loss.</p>	B	2	5	PDI done on all units prior to delivery.	C	2	8	1) Repair kits available
	<p>Hose blows off when not connected correctly.</p>	C	4	18	Training done by supplier. PPE supplied by the mine. (Goggles, hard hat, boots, gloves)	D	4	21	1) All connections to be free of grit and or staple to be in correct position.
	<p>Hose blows off Jackpot while inflating causing delays.</p>	C	4	18	Training done by supplier. PPE supplied by the mine. (Goggles, hard hat, boots, gloves)	D	4	21	1) All connections are to be free of grit. 2) Correct nozzle to be used 3) Nozzle to be connected correctly.
	<p>Bursting of Jackpot causing high pressure water in eyes.</p>	B	2	5	PPE supplied by mine (gloves, hard hat, boots, goggles)	D	2	12	1) Follow correct installation procedures. 2) Wear goggles. 3) Remotely pre-stress.
	<p>Over inflation of Jackpot causing rupture.</p>	A	1	1	Training. Safety pistol factory set to 20mpa. Use correct nozzle with relief valve, factory set 10-12Mpa	B	1	2	3) Wear PPE supplied by the mine. (Goggles, hard hat, boots, gloves) 4) Use gauge supplied to check pressure relief daily
	<p>Struck by hose while under pressure.</p>	C	4	8	Training given by supplier.	C	4	8	2) Attach hoses securely.
	<p>11. Support Selection</p>	<p>Prop fails leading to FOG injury and production delays</p>	A	1	1	Use support with required resistance and energy absorption capability as per Rock Engineering specifications	C	1	4

<p>12. Salvage. Pots should not be reshaped for reuse. Pots should not be used to cook in. Old timber with PSDs attached should not be burned until units are removed.</p>	<p>Pot explodes when exposed to heat causing serious injury or death.</p>	<p>A</p>	<p>1</p>	<p>1</p>	<p>Training Awareness Supervision. Pots to be perforated with a spike to drain water. <i>Never heat</i> i.e. Cutting torch.</p>	<p>D</p>	<p>5</p>	<p>24</p>	<p>Pots only to be used for what they are designed for i.e. pre-stressing of poles.</p>
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