

AUTOROCK

PRODUCT INFORMATION AND RISK ASSESSMENT



Solutions from Materials Technology



MINOVA

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RISK ASSESSMENT

The Safe Manufacturing, Maintenance, Handling, Transport, Storage and Operation of the Minova Autorock Drill Rig



Risk Assessment Date	April 2008
Revised	March 2010
Next Revision Date	March 2012

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PRODUCT INFORMATION

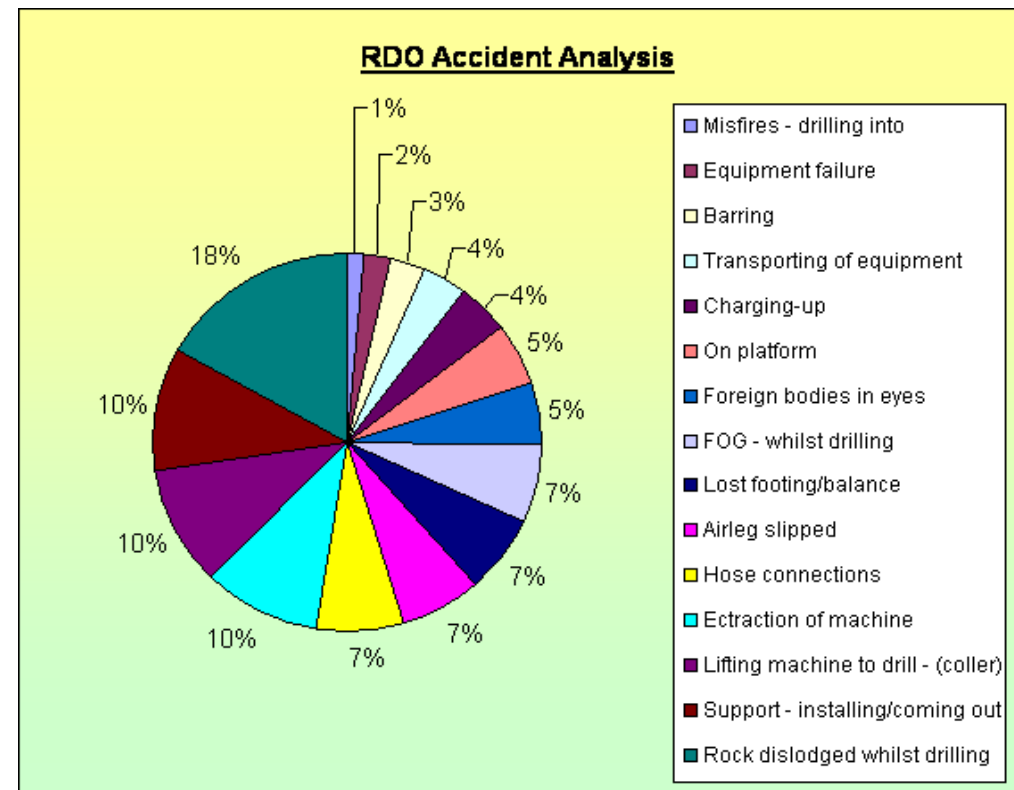
INTRODUCTION

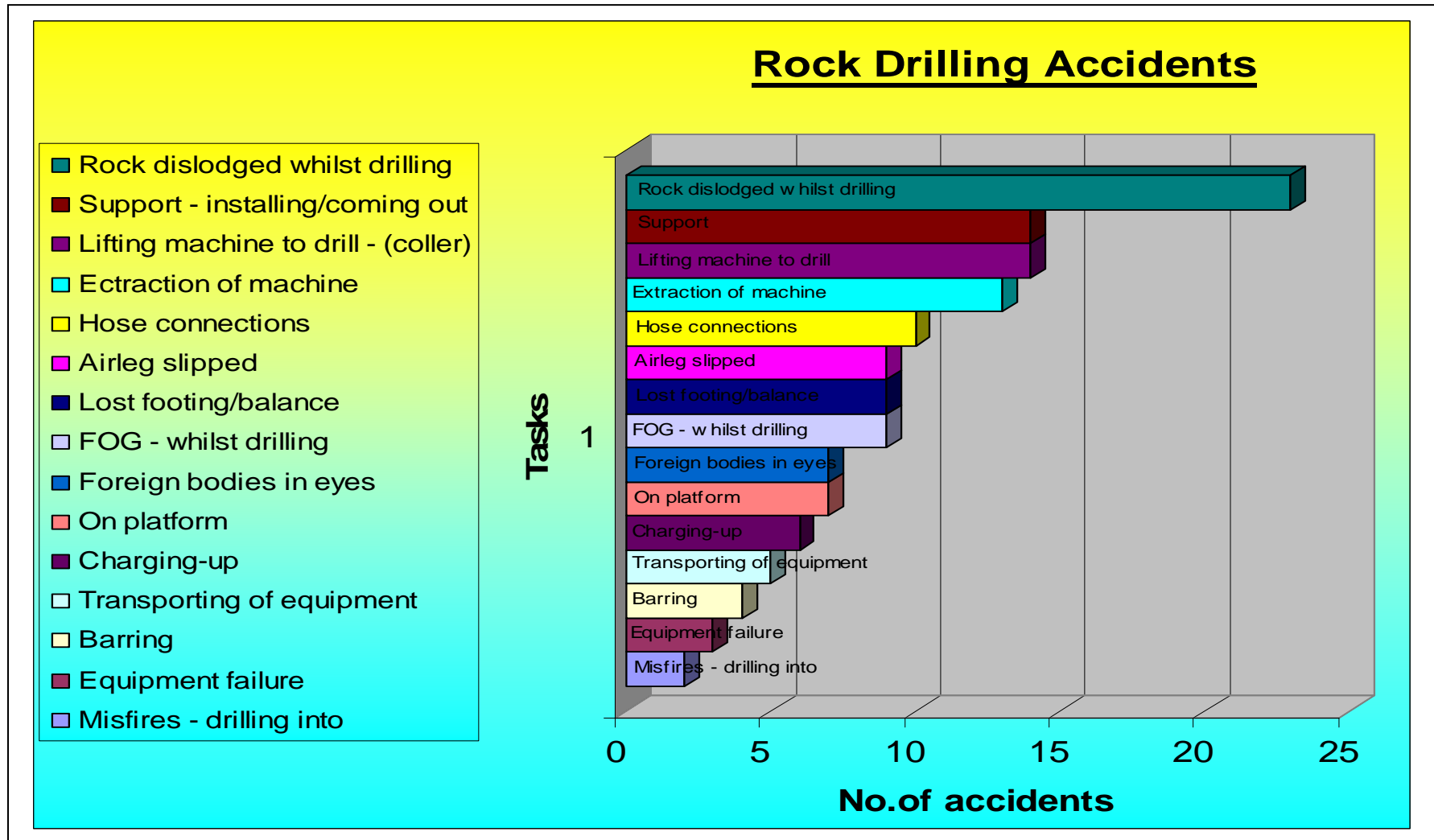
WHY USE AN AUTOROCK DRILL RIG TO DRILL SUPPORT HOLES AND INSTALL ROOF BOLT SUPPORT?

SEE ACCIDENT STATISTICS BELOW:

RDO Accident Analysis

Accident Types	No. accidents	Percentage
Misfires - drilling into	2	1%
Equipment failure	3	2%
Barring	4	3%
Transporting of equipment	5	4%
Charging-up	6	4%
On platform	7	5%
Foreign bodies in eyes	7	5%
FOG - whilst drilling	9	7%
Lost footing/balance	9	7%
Airleg slipped	9	7%
Hose connections	10	7%





Why use a Minova Autorock Rig to drill support holes?

Due to the large number of serious injuries to Rock Drill Operators in the mine, it has become essential that Mine Management take action to reduce and where possible eliminate accidents and injuries that leads to "loss"



AUTOROCK IN ACTIVE SERVICE AT KROONDAL MINE. THIS PARTICULAR MACHINE HAS BEEN USED FOR MORE THAN 2 YEARS ON A DAILY BASIS WITHOUT BREAKING DOWN ONCE.

Note the remote drilling from a safe are! The operators were sitting at a safe distance in a well supported area.

It is a known fact that up to 50% of injuries is rock drill related. Up to 70% of all fatal injuries happen in the stope between the stope face and permanent support. In many cases FOG occurs when seismic events take place or simply due to bed or fracture separation. For many years it has been realized that the ideal solution would be to clamp these bedding planes and fractures together with the use of in stope bolting. Due to space restraints, the use of conventional machines and air legs for this purpose was inadequate and also extremely hazardous. Thanks to the new technology of an Autorock Support Rig, it is now possible to drill and support holes at 90 degrees to the dip of the strata in the stopes ranging from as low as 80cm up to 5m high! The best feature is that the rig is remotely operated from a supported area.

MINOVA currently supplies the Autorock to various mines in the mining industry with excellent improvement on safety and productivity. An Autorock machine costs only a fraction of the capital layout required for one the larger mechanized machines. The much larger mechanized units is not suitable for the low in stope support drilling. Proper implementing of the system will lead to drastically improved safety records and also guaranteed cost savings.

RISK ASSESSMENT: MINOVA AUTOROCK DRILL RIG

This study serves to prove the commitment of the management of MINOVA towards the elimination, control and minimising the risks to the Health and Safety of Employees, in order to provide an environment that is free from hazards as required by legislation.

A Swift (STRUCTURED WHAT IF TECHNIQUE) hazard identification technique was conducted. The Swift technique is a system-orientated technique, which examines complete systems or sub-systems.

MINOVA is an international Mining Support Products Supply Company that is ISO 9001:2008 accredited. (Member of the Orica Group)

MINOVA experts including Chemical and Mechanical Engineers, Quality Assurance personnel, Mining Specialists conducted the risk assessment jointly to ensure a product of the highest quality at all times.

1. Aim:

1.1 The aim of the study is to:

- 1.1.1 Identify and assess the hazards and risks to which the product may expose employees in the working place.
- 1.1.2 Ensure the supply of the highest quality product to our clients at all times
- 1.1.3 Ensure that quality-manufacturing practices are maintained.
- 1.1.4 Develop safe manufacturing, handling, storage, transport and application procedures of the MINOVA Autorock Drill.

2. Objective:

- 2.1 The objective of the study is to conduct a SWIFT study on the manufacturing, handling, storage, transport and use of a MINOVA Autorock Drill.
- 2.2 In analysing hazards, reviewing existing controls and/or making recommendations, regarding potential hazards to the health and safety of employees.

3. Scope:

- 3.1 To do a Swift document on the manufacturing, handling, storage, transport and the safe and effective use of MINOVA Autorock Drill.

4. Methodology

- 4.1 Through using personnel with the technical experience and knowledge, hazards and problem areas were identified that could pose a threat to the health and safety of employees.
- 4.2 A risk matrix, included in this report, was used to prioritise all hazards and risks identified.
- 4.3 Recommendations were then made, where existing controls were found according to the team to be insufficient for control and eliminating of existing hazards. See the risk assessment and proposed standard attached to this document.

5. Hazards identified

- 5.1 See Executive Summary

6. Acknowledgement

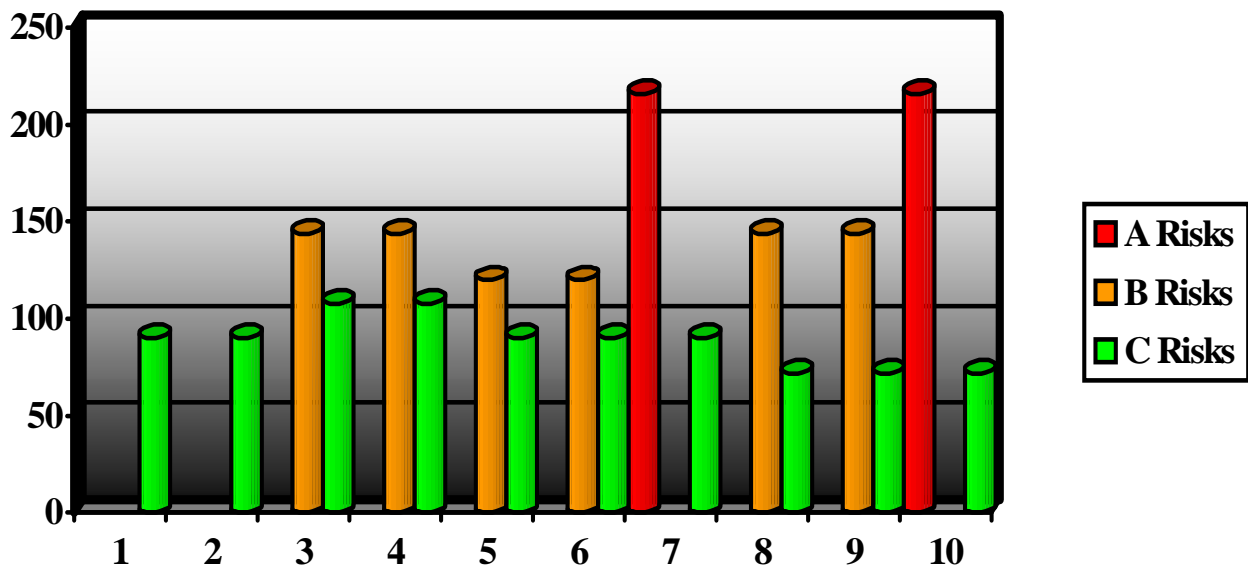
- 6.1 The team would like to "Thank" the management of MINOVA for the opportunity to be part of this Risk Assessment team, affording them the opportunity to make a contribution in making the mining industry a safer place.

EXECUTIVE SUMMARY

Executive Summary (Risk Profile)

Risk ranking taking into consideration current safeguards and risk reduction following recommendations

Legend	
A	High
B	Medium
C	Low



Hazards identified

1. Drill Rig not manufactured to manufacturer specification
2. Failure to check that the raw materials and components comply with MINOVA manufacturer specifications prior to using it in the manufacturing process.
3. Operator not trained and found competent in the safe operation of the drill rig.
4. Components of the Autorock Drill Rig not inspected for damage prior to use.
5. Failure of the Responsible Supervisor to inspect the components of the Autorock drill rig on a regular basis
6. Drill Rigs not maintained
7. Exchange Autorock drill rig units not available.
8. Drill Rig roughly handled when transported
9. Drill Rig not stored in safe, dry and secure place.
10. Disruption in compressed air feed while drill rig is in use.

TEAM MEMBERS

TEAM MEMBERS

Name	Designation
Alfredo Piroddi	Sales Director
Frank Johnson	Autorock Development Engineer
Peter Henning	Sales Manager
H van Wyk	Autorock Manager
David Hobbs	S.H.E.Q. Manager
Nico Grobler	Area Technical Manager
S Nkuna	Safety Representative

B R Henning	Risk Assessment Facilitator Ultimate Risk Management Solutions
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RISK MATRIX

RISK MATRIX

PROBABILITY		CONSEQUENCE		EXPOSURE	
Can it happen?		What injury / damage could we expect?		How often people are currently exposed to the hazard?	
Well expected / Happens often	7	Catastrophic / Disaster / Multiple Fatals / + R5 Mil	7	Continuous / Full Shift	7
Quite possible	6	Fatality / Severe Permanent Disability / R1 - R5 Mil	6	Frequent / Daily	6
Unusual - Has happened here before	5	Very Serious Injury (ICU) / R500 000 - R1 Mil	5	Often / Weekly	5
Remotely Possible - Happened elsewhere	4	Serious Injury (ICU) / R100 000 - R500 000	4	Occasional / Monthly	4
Very unlikely but conceivable - Hasn't happened yet	3	Disabling Injury / R1 000 - R100 000	3	Unusual / Yearly	3
Practically Impossible - 1 in a million chance	2	Treat & Return Injury - Below R1 000	2	Rare / Within 5 Years	2
Virtually Impossible - Full certainty	1	Near Miss Injury / Damage	1	Remote / Beyond 5 Years	1

RISK RATING = Probability X Consequence X Exposure



RISK ASSESSMENT WORKSHEETS

Category	Hazards	What If	Consequences	Existing controls	C	E	P	RR	Additional Recommended controls	C	E	P	RR	Responsible Person
Manufacturing of Drill Rig Drill Rig consists of: - Drill Rig Cradle including: <ul style="list-style-type: none"> • Cradle framework • Telescopic support legs • Percussion Drill Drive Cylinder and PVC Belt • Percussion drill retaining key. • Retainer pin • Wheels where applicable 	Drill Rig not manufactured to manufacturer specification	The manufacturing process is not quality checked.	1. Substandard Product. 2. Financial loss to MilNOVA , 3. Supply company not able to deliver orders on time. 4. In the absence of drill rigs users have to convert to conventional drilling methods that could result in serious injury or fatal.	1. Quality check are conducted throughout the process and recorded 2. Manufacturer ISO 9001/2000 accredited	6	5	3	90	Manufacturer specification and manufacturing process to be adhered to at all times.	6	5	3	90	Manufacturing and quality control staff

Category	Hazards	What If	Consequences	Existing controls	C	E	P	RR	Additional Recommended controls	C	E	P	RR	Responsible Person
Control Bank including: <ul style="list-style-type: none"> • Frame • Air Control Unit and valves: <ul style="list-style-type: none"> - One for percussion drill - One for drive cylinder - One for clamping cylinders. - Water control valve - 25mm air and 12mm water hoses and connections 														

Category	Hazards	What If	Consequences	Existing controls	C	E	P	RR	Additional Recommended controls	C	E	P	RR	Responsible Person
Raw materials and components not manufactured by manufacturer or by supplier not quality controlled	Raw materials and components used on Drill Rig not manufactured by the supplier not quality assured and checked.	A quality check is not done on raw material or components used from other suppliers to ensure quality control.	1. Inferior product. 2. Premature failure of Drill Rig. 3. In the absence of drill rigs users have to convert to conventional drilling methods that could result in serious injury or fatal.	1. Quality check are conducted throughout the process and recorded 2. Manufacturer ISO 9001/2 accredited	6	5	3	90	1. Only products and raw material with quality control certification to be used. 2. Certificates to be kept for reference in the event of serious injury or incident. 3. Random checks by MINOVA quality controllers.	6	5	3	90	Manufacturing and quality control staff

<p>Training, license to operate, appointment and safe operation of the Autorock Drill Rig.</p>	<p>Operator not trained and found competent in the safe operation and handling of the drill rig.</p>	<p>Operator not trained and found competent in the safe operation of the drill rig.</p>	<p>Serious injury Fatal Damage to drill rig Production loss Legal requirements not met.</p>	<p>Trained and certificated by accredited personnel. Competent mining supervisory staff.</p>	<p>6</p>	<p>6</p>	<p>4</p>	<p>144</p>	<p>1. The Operator must be trained in the proper operation of the drill rig, familiarised with all the hazards and risks pertaining to the machine and found competent in the operating of the machine prior to being issued with a license to operate. 2. Only licensed competent operators may be appointed to operate the drill rig. 3. See operating procedure and risk assessment.</p>	<p>6</p>	<p>6</p>	<p>3</p>	<p>108</p>	<p>1. Training Manager 2+3. Mine Supervisors</p>
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Category	Hazards	What If	Consequences	Existing controls	C	E	P	RR	Additional Recommended controls	C	E	P	RR	Responsible Person
Pre-use inspection and over-inspection.	Components of the Drill Rig not inspected for damage, wear or operability prior to use.	The components of the Drill Rig are not inspected for damage, wear or operability prior to use.	1. Aggravating of existing damage to components 2. Production loss 3. In the absence of drill rigs users have to convert to conventional drilling methods that could result in serious injury or fatal.	Competent appointed personnel Competent mining supervisory staff.	6	6	4	144	1. All components of the drill rig must be inspected for damage, wear and proper operation prior to use and the pre-use checklist completed. 2. Damaged components must be replaced immediately or if not possible the drill rig must not be used. A spare unit to be available at all times 3. See operational procedure and risk assessment.	6	6	3	108	1,2+3 Operator and mine Supervisory staff
		Responsible Supervisor do not on a random basis over inspect components on drill rig	1. Aggravating of existing damage to components 2. Production loss 3. In the absence of drill rigs users have to convert to conventional drilling methods that could result in serious injury or fatal.	Competent mining supervisory staff.	6	5	4	120	Responsible Supervisors must on a random basis (at least weekly) over inspect the components of the drill rig to ensure damaged equipment is not used and that the operator performs his pre-use inspection to standard.	6	5	3	90	Production Supervisors

Category	Hazards	What If	Consequences	Existing controls	C	E	P	RR	Additional Recommended controls	C	E	P	RR	Responsible Person
Maintenance of Drill Rigs	Drill Rigs not maintained	Drill Rigs are not maintained.	1. Pre-mature failure of components 2. Production loss 3. In the absence of drill rigs users have to convert to conventional drilling methods that could result in serious injury or fatal. 4. Financial loss	Competent engineering staff.	6	5	4	120	1. A maintenance schedule must be drawn up to ensure that the units are kept in a good and serviceable condition. 2. It is recommended that the supplier train end user artisans in proper maintenance procedures.	6	5	3	90	Engineering Supervisors
	Exchange units not available when units require to be maintained.	Exchange units not available when units require to be maintained.	1. In the absence of exchange drill rigs users have to convert to conventional drilling methods that could result in serious injury or fatal. 2. Production loss	Competent supervisory staff	6	6	6	216	It is recommended that exchange units and spare components are purchased to ensure that production can continue even when drill rig units break down or when they are to be maintained.	6	5	3	90	Production Supervisors

Category	Hazards	What If	Consequences	Existing controls	C	E	P	RR	Additional Recommended controls	C	E	P	RR	Responsible Person
Handling of Drill Rigs	Drill Rig rough handled when transported.	The Drill Rig is rough handled by manufacturer or end user	1. Damage to components. 2. In the absence of drill rigs users have to convert to conventional drilling methods that could result in serious injury or fatal.		6	6	4	144	1. Drill Rigs must be handled with care to prevent damage to any equipment. 2.The control bank and hoses must be secured to the unit by means of the retaining straps before it is transported	6	6	2	72	Operators and Supervisors

Category	Hazards	What If	Consequences	Existing controls	C	E	P	RR	Additional Recommended controls	C	E	P	RR	Responsible Person
Storage of Drill Rigs	Drill Rig not stored in safe, dry and secure place.	The drill rig id not stored in a safe, dry and secure place	1. Damage to drill rig. 2. Rust 3. In the absence of drill rigs, users have to convert to conventional drilling methods that could result in serious injury or fatal.		6	6	4	144	Drill Rigs must be stored in a safe, dry place.	6	6	2	72	Operators Supervisors
Operational Hazards	Disruption in compressed air feed while drill rig is in use.	There is a disruption in compressed air feed while the drill rig is in use.	Cradle housing will dislodge and could result in: 1. F.O.G. 2. Damage to drill rig. 3. Fall on a nearby person		6	6	6	216	A safety valve must be installed above the compressed air feed and must be closed to keep the clamping cylinders under tension. It is also recommended that a safety sling attached to a nearby roofbolt or tempory support jack is tied to the machine to stop it from falling over	6	6	2	72	Company Technical Engineer Operator and supervisor to ensure

SAFETY RECOMMENDATIONS

MINOVA Autorock Drill Rig

1. Description

1.1 Drill Rig consisting of:

1.1.1 Drill Rig Cradle including:

- Cradle framework
- Telescopic clamping cylinders
- Lift Cylinder with PVC Belt
- Drilling Machine (Air, electric or hydro powered unit)
- Drill retaining key.
- Locking plate
- Wheels where applicable
- Control valve
- Collaring Device

1.1.2 Control Bank including:

- Frame
- Air Control Unit
- Control valves:
 - One air control valve for the percussion drilling unit
 - One air control valve for the lifting cylinder.
 - One air control valve for the Telescopic clamping cylinders.
 - Water control valve
 - One control for the lifting cylinder
- 25mm air and 12mm water hoses and connections or equivalent water feed for hydro powered units.

2. Manufacturing of the Autorock Drill Rig.

- 2.1 Manufacturer specification and manufacturing process to be adhered to at all times.
- 2.2 Only products and raw material with quality control certification to be used.
- 2.3 Quality Assurance certificates to be kept for reference in the event of injury, damage or loss.
- 2.4 Random checks by MINOVA quality controllers to be conducted and records to be kept.

3. Training, Approval to operate appointment and safe operation of the Autorock Drill Rig.

- 3.1 The Operator must be trained in the proper operation of the drill rig, familiarised with all the hazards and risks pertaining to the machine and found competent in the operation of the machine prior to certification.
- 3.2 Only approved competent operators may be appointed to operate the Autorock drill rig.
- 3.3** See operating procedure and risk assessment.

4. Pre-use inspection and over-inspection.

- 4.1 All components of the drill rig must be inspected for damage, wear and proper operation prior to use and the pre-use checklist must be completed.
- 4.2 Damaged components must be replaced immediately or if not possible the drill rig must not be used. (Make use of a spare exchange unit)
- 4.3 See operational procedure and risk assessment.
- 4.4 Responsible Supervisors must on a random basis (at least weekly) over inspect the drill rigs to ensure damaged equipment is not used and that the operator performs his pre-use inspection to standard.

5. Maintenance of Drill Rigs

- 5.1 A maintenance schedule must be drawn up to ensure that the units are kept in a good and working condition. (call up system)
- 5.2 It is recommended that the supplier train end user artisans in proper maintenance procedures.
- 5.3 It is further recommended that exchange units and spare components are purchased to ensure that production can continue even when drill rig units break down or when it is serviced.

Handling of Drill Rigs

- 6.1 Drill Rigs must be handled with care to prevent damage to the machine or components.
- 6.2 The control bank and hoses must be secured to the unit by means of the retaining straps before it is transported.

7. Storage of Drill Rigs

- 7.1 Drill Rigs must be stored in a safe, dry place to protect them against exposure to damage and rust.

8. Operational Hazards and recommendations.

- 8.1 See Operational Risk Assessment

**The Safe Drilling of support holes
and installation of support tendons
by means of a MINOVA Autorock Drill Rig**

Date of risk assessment	April 2008
Revised	March 2010
Revision Date	March 2012

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- 4. RISK MATRIX**
- 5. RISK ASSESSMENT WORK SHEETS**
- 6. SAFETY RECOMMENDATIONS FROM OPERATIONAL RISK ASSESSMENT CONDUCTED.**
- 7. PROPOSED STANDARD FOR THE SAFE DRILLING OF SUPPORT HOLES USING THE MINOVA AUTO ROCK SUPPORT DRILL RIG.**

INTRODUCTION

INTRODUCTION

SAFE DRILLING OF SUPPORT HOLES USING THE MINOVA AUTOROCK DRILL RIG.

This study serves to prove the commitment of the management of MINOVA towards the elimination, control and minimising the risks to the Health and Safety of Employees, in order to provide an environment that is free from hazards as required by legislation.

A Swift (STRUCTURED WHAT IF TECHNIQUE) hazard identification technique was conducted. The Swift technique is a system-orientated technique, which examines complete systems or sub-systems.

MINOVA is an international Mining Support Products Supply Company that is ISO 9001:2008 accredited. (Member of the Orica group of Companies)

MINOVA experts, including chemical and mechanical engineers as well as mining Specialists, conducted the risk assessment jointly, to ensure that this product is of the highest quality, and can be used safely, correctly, with minimal production interruption enhancing safety and productivity in the work place.

1. Aim:

- 1.1 To identify and assess the hazards and risks to which the product may expose employees in the working place when drilling support holes by means of the MINOVA Autorock Drill Rig.

2. Objective:

- 2.1 The objective is to conduct a SWIFT study on the safe drilling of support holes by means of and Autorock Drill Rig.

3. Scope:

- 3.1 To do a Swift document on the safe drilling of support holes using the MINOVA Autorock Drill Rig.

4. Methodology

- 4.1 Through using personnel with expert technical and mining experience, hazards and problem areas were identified that could pose a threat to the health and safety of employees.
- 4.2 A risk matrix, included in this report, was used to prioritise all hazards and risks identified.
- 4.3 Recommendations were then made, where existing controls were found according to the team to be insufficient for control and eliminating existing hazards. See the risk assessment and safety recommendations attached to this document.

5. Hazards identified

- 5.1 See Executive Summary

6. Acknowledgement

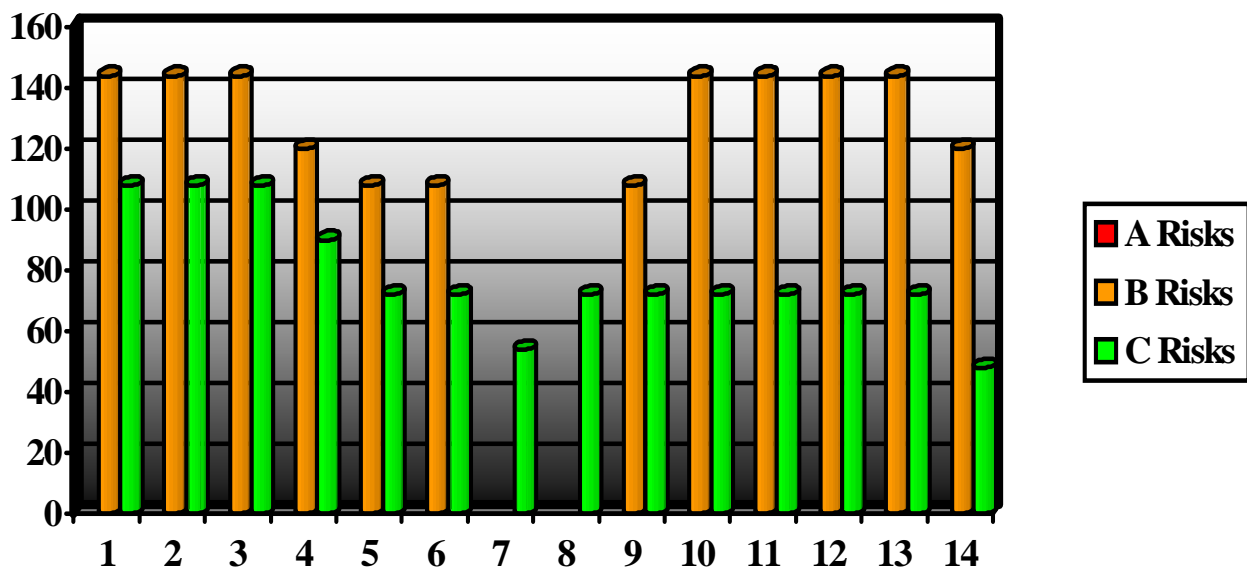
- 6.1 The team would like to "Thank" the management of MINOVA for the opportunity to be part of this Risk Assessment team, affording them the opportunity to make a contribution in making the mining industry a safer place.

EXECUTIVE SUMMARY

Executive Summary (Risk Profile)

Risk ranking taking into consideration current safeguards and risk reduction following recommendations

Legend	
A	High
B	Medium
C	Low



Hazards identified

1. Panel not examined, barred and made safe in accordance with mine standard
2. Panel not supported to mine standard
3. Support holes not marked to mine standard
4. Incompetent Persons operating a drill rig
5. Incorrect size Auto drill rig used.
6. Drill rig operator not in possession of correct tools and equipment for task
7. Drill Rig Operator operating drill rig in panel before instructed to.
8. Required PPE in good condition not worn.
9. Autorock Drill Rig not inspected prior to being used.
10. Drill rig not prepared to standard
11. Holes not drilled as per safety and operational recommendations
12. Roof bolt not installed as per safety and operational recommendations
13. After drilling procedures as per safety and operational recommendations not adhered to
14. Excessive noise

TEAM MEMBERS

TEAM MEMBERS

Name	Designation
Alfredo Piroddi	Sales Director
Frank Johnson	Autorock Design Engineer
Peter Henning	Sales Manager
H van Wyk	Autorock Manager
David Hobbs	S.H.E.Q. Manager
Nico Grobler	Area Technical Manager
S Nkuna	Safety Representative

B R Henning	Risk Facilitator Ultimate Risk Management Solutions
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RISK MATRIX

RISK MATRIX

PROBABILITY		CONSEQUENCE		EXPOSURE	
Can it happen?		What injury / damage could we expect?		How often are people currently exposed to the hazard?	
Well expected / Happens often	7	Catastrophic / Disaster / Multiple Fatals / + R5 Mil	7	Continuous / Full Shift	7
Quite possible	6	Fatality / Severe Permanent Disability / R1 - R5 Mil	6	Frequent / Daily	6
Unusual - Has happened here before	5	Very Serious Injury (ICU) / R500 000 - R1 Mil	5	Often / Weekly	5
Remotely Possible - Happened elsewhere	4	Serious Injury (ICU) / R100 000 - R500 000	4	Occasional / Monthly	4
Very unlikely but conceivable - Hasn't happened yet	3	Disabling Injury / R1 000 - R100 000	3	Unusual / Yearly	3
Practically Impossible - 1 in a million chance	2	Treat & Return Injury - Below R1 000	2	Rare / Within 5 Years	2
Virtually Impossible - Full certainty	1	Near Miss Injury / Damage	1	Remote / Beyond 5 Years	1

RISK RATING = Probability X Consequence X Exposure



RISK ASSESSMENT WORKSHEETS

Category	Hazards	What If	Consequences	Existing controls	C	E	P	RR	Additional Recommended controls	C	E	P	RR	Responsible Person
Prepare to drill support holes.	Panel not examined, barred and made safe in accordance with mine standard	The panel is not examined, barred and made safe in accordance with mine standard	FOG Multiple fatal Serious injury Heat related illnesses Flammable gas explosions Misfires not treated resulting in explosion. Production loss Financial loss Damage to equipment and infrastructure.	1. Mine Standards 2. Proposed safe work standard by MINOVA 3. Competent appointed personnel 4. Supervision 5. Legal requirements	6	6	4	144	1. Miner to examine, bar and make panel safe in accordance with the mine standard before drill rig operator drill support holes or install support tendons. 2. Drill Rig Operator to be trained in barring and making safe practices. This will enable him to ensure that he drill in safe conditions.	6	6	3	108	1. Miner 2. Training centre.

Category	Hazards	What If	Consequences	Existing controls	C	E	P	RR	Additional Recommended controls	C	E	P	RR	Responsible Person
	Panel not supported to mine standard	The panel is not supported to mine standard	FOG Multiple fatal Serious injury Heat related illnesses Flammable gas explosions Production loss Financial loss Damage to equipment and infrastructure.	1. Mine Standards 2. Proposed safe work standard by MINOVA 3. Competent appointed personnel 4. Supervision 5. Legal requirements	6	6	4	144	1. Miner to install temporary support and if required, netting, in accordance with the mine standard before drill rig operator drill support holes or install support tendons. 2. Drill Rig Operators must be trained in the correct support standards to enable them to identify sub standard support and ensure that support is to standard prior to drilling.	6	6	3	108	1. Miner 2. Mine Training centre.

Category	Hazards	What If	Consequences	Existing controls	C	E	P	RR	Additional Recommended controls	C	E	P	RR	Responsible Person
	Support holes not marked to mine standard	If the support holes are not marked to mine standard	Inadequate support Drilling into misfires FOG Fatal Serious injury Production loss Damage to equipment and infrastructure	Competent appointed personnel	6	6	4	144	1. Miner or competent person to mark support holes to mine standard before drill rig operator drill support holes or install support tendons. 2. Drill Rig Operators must be trained in the support requirements of the mine to enable them to identify incorrect marking practices. In so doing they can assist to ensure correct drilling.	6	6	3	108	1. Miner/ Competent person 2. Mine Training centre
	Incompetent Persons operating a drill rig	An incompetent person is allowed to operate a drill rig	FOG Fatal Serious injury Damage to equipment and infrastructure Production loss. Financial loss		6	5	4	120	The miner must ensure that only a competent and appointed Autorock drill rig operator drill and install the support tendons with an Autorock drill rig.	6	5	3	90	Production Supervisors

Category	Hazards	What If	Consequences	Existing controls	C	E	P	RR	Additional Recommended controls	C	E	P	RR	Responsible Person
	Incorrect size Auto drill rig used.	The incorrect size Auto drill rig is used.	Substandard support Installed (short holes or jumper wont fit) FOG Fatal Serious injury Damage to equipment and infrastructure Production loss. Financial loss	Customer responsible to ensure that the correct category auto drill rig is purchased from supplier and used.	6	6	3	108	The workplace official must ensure that the correct size Autorock drill rig is used for the application (panel height – stoping width ratio). See the Safety and Operational Recommendations by MINOVA attached	6	6	2	72	Responsible Supervisor Drill rig operator
	Drill rig operator not in possession of correct tools and equipment for task	The Drill rig operator not in possession of correct tools and equipment for task	Drill rig cannot be used Production delay. Production loss In the absence of a drill rig the workers may revert to conventional methods that may result in serious or fatal injury		6	6	3	108	The Miner must ensure that the Autorock drill rig operator have the correct tools and equipment to perform the task safely. See the Safety and Operational Recommendations by MINOVA attached	6	6	2	72	Production Supervisor

Category	Hazards	What If	Consequences	Existing controls	C	E	P	RR	Additional Recommended controls	C	E	P	RR	Responsible Person
Duties of the Autorock drill rig Operator	Drill Rig Operator operating drill rig in panel before instructed to.	The Drill Rig Operator operates the drill rig in a panel before instructed to.	FOG Fatal Serious injury Damage to equipment and infrastructure Production loss. Financial loss		6	3	3	54	The drill rig operator may only on instruction of the miner, prepare to drill the holes and to install Support tendons. See the Safety and Operational Recommendations by MINOVA attached	6	3	3	54	Drill rig operator and miner
	Required PPE in good condition not worn.	The required PPE in good condition is not worn.	Fatal Serious injury		6	6	2	72	Personal protective equipment, as supplied by the mine, and in good condition, must be worn by drill rig operators at all times. See the Safety and Operational Recommendations by MINOVA attached	6	6	2	72	Drill rig operators and supervisors

Category	Hazards	What If	Consequences	Existing controls	C	E	P	RR	Additional Recommended controls	C	E	P	RR	Responsible Person
	Autorock Drill Rig not inspected prior to being used.	The Autorock Drill Rig is not inspected prior to being used.	FOG Fatal If a drill rig becomes inoperable the workers may revert to conventional methods that may result in serious or fatal injury		6	6	3	108	The Autorock drill rig operator must inspect the Autorock drill rig and complete the pre-use checklist. Report all sub standard equipment to the miner as soon as possible.	4	6	3	72	Rock Drill Operator and Supervisor
	Care not taken when Autorock drill is transported	Care is not taken when Autorock drill is transported	Injury to drill rig operator Damage to equipment Production delay In the drill rig is damaged the workers may revert to conventional methods that may result in serious or fatal injury		6	6	4	144	The Autorock drill rig must be transported as described in the Safety and Operational Recommendations	6	6	3	108	Rock drill operator and supervisor

Category	Hazards	What If	Consequences	Existing controls	C	E	P	RR	Additional Recommended controls	C	E	P	RR	Responsible Person
	Drill rig not prepared to standard	The drill rig not prepared to standard	Air connections can dislodge resulting in injury to persons and damage to equipment If the drill rig is damaged the workers may revert to conventional methods that may result in serious or fatal injury		6	6	4	144	The drill rig must be prepared as described in the Safety and Operational Recommendations.	6	6	3	108	Rock drill operator and supervisor

Category	Hazards	What If	Consequences	Existing controls	C	E	P	RR	Additional Recommended controls	C	E	P	RR	Responsible Person
	Holes not drilled as per safety and operational recommendations	Holes not drilled as per safety and operational recommendations	Substandard support FOG Fatal Serious injury Damage to drill rig Production loss		6	6	4	144	Holes must be drilled as described in the Safety and Operational Recommendations.	6	6	3	108	Drill Rig Operator and Supervisor
	Support tendons not installed as per safety and operational recommendations	Support tendons are not installed as per safety and operational recommendations	Substandard support FOG Fatal Serious injury Damage to equipment Production loss		6	6	4	144	Support tendons must be installed as described in the Safety and Operational Recommendations.	6	6	3	108	Drill Rig Operator and Supervisor
	After drilling procedures as per safety and operational recommendations not adhered to	The after drilling procedures as per safety and operational recommendations not adhered to	Damage to drill rig Injury to person		6	6	4	144	The after drilling procedures as per safety and operational recommendations must be adhered to at all times.	6	6	3	108	Drill Rig Operator and Supervisor

**RECOMMENDATIONS
FROM
RISK ASSESSMENT**

Safety Recommendations from Risk Assessment: Drilling of support holes and installing support tendons by means of a MINOVA Autorock Drill Rig

1. Safety Recommendations

1.1 Duties of the miner

- 1.1.1 Miner to examine, bar and make panel safe in accordance with the mine standard before drill rig operator drill support holes or install support tendons.
- 1.1.2 Miner/Competent persons to install temporary support and if required, netting, in accordance with the mine standard before the drill rig operator drill support holes or install support tendons.
- 1.1.3 Miner/Competent person to mark support holes to mine standard before drill rig operator drill support holes.
- 1.1.4 The miner must ensure that only a competent and appointed Autorock drill rig operator drill support holes and install the support tendons.
- 1.1.5 The workplace official must ensure that the correct size Autorock drill rig is used for the application (panel height – stoping width ratio).
- 1.1.6 The Miner must ensure that the Autorock drill rig operator have the correct tools and equipment to perform the task safely.

Note: Support tendons could be:

- Resin bolts
- Cable anchors
- Hydro bolts

1.2. Duties of the Autorock drill rig Operator

- 1.2.1 Only on instruction of the miner, prepare to drill the holes and install Support tendons.
- 1.2.2 Personal protective equipment, as supplied by the mine, and in good condition, must be worn at all times.

- 1.2.3 The Autorock drill rig operator must inspect the Autorock drill rig and complete the pre-use checklist. Report all sub standard equipment to the miner.
- 1.2.4 The Autorock drill rig must be transported as described in the Safety and Operational Recommendations
- 1.2.5 The drill rig must be prepared as described in the Safety and Operational Recommendations.
- 1.2.6 A safety valve to be installed above the air feed to the clamping cylinders to ensure that it remains under pressure even if air feed is stopped for any reason. In addition a safety sling attached to the nearest support jack or roofbolt to be tied to the Autorock to stop it from falling over and hurt somebody or getting damaged.
- 1.2.7 Holes must be drilled as described in the Safety and Operational Recommendations.
- 1.2.8 The after drilling procedures as per safety and operational recommendations must be adhered to at all times.

PROPOSED WORK STANDARD

MINOVA RSA	Proposed Safe Work Standard	Standard Number:
	Drill a support hole with an Autorock in-stope support drill rig and Install support tendons	Draft date: April 2008

1. Prepare to drill support holes.

1.1 Miner to:

- 1.1.1 Examine and make panel safe in accordance with the mine standard.
- 1.1.2 Install temporary support and if required, netting, in accordance with the mine standard.
- 1.1.3 Prepare and mark the support holes to standard.
- 1.1.4 Ensure that only a competent and appointed Autorock drill rig Operator drill and install the Support tendons
- 1.1.5 Ensure that the correct size Autorock drill rig is used for the application (panel height – stoping width ratio).
- 1.1.6 Ensure that the Autorock drill rig operator have the correct tools and equipment to perform the task safely.

1.2 Duties of the Autorock drill rig Operator

- 1.2.1 On instruction of the Miner, prepare to drill the holes, to install Support tendons.

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1.2.2 Personal protective equipment, as supplied by the mine, and in good condition, must be worn at all times. The following is the minimum requirement:

- 1.2.2.1 Ear protection
- 1.2.2.2 Eye protection
- 1.2.2.3 Hard hat
- 1.2.2.4 Approved Safety Lamp
- 1.2.2.5 Hand gloves
- 1.2.2.6 Long Sleeve Overalls with reflective strips
- 1.2.2.7 Steel toe cap boots
- 1.2.2.8 Self Rescue pack
- 1.2.2.9 Safety Belt (mine supplied) when working in steep areas or at heights.

1.2.3 Ensure that you are in possession of the necessary tools and equipment:

- 1.2.3.1 Pinch bar of correct length
- 1.2.3.2 Stilson wrench
- 1.2.3.3 Jumper extractor
- 1.2.3.4 No1 and No 2 Starter Jumpers
- 1.2.3.5 Knock of bit Tool
- 1.2.3.6 2.5kg hammer
- 1.2.3.7 Spinning Adaptor
- 1.2.3.8 T-Spanner
- 1.2.3.9 Autorock drill rig

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- 1.2.3.10 Lubricator and lubricator oil
- 1.2.3.11 Correct length 12.5mm and 25mm hoses
- 1.2.3.12 12.5 and 25 mm hose clamps.
- 1.2.3.13 Screw driver
- 1.2.3.14 25mm and 12.5mm hose menders.
- 1.2.3.15 Safety sling or chain with bolts and nuts for all hose connections.
- 1.2.3.16 Water tube measuring staff.

1.2.4 Inspect the Autorock drill rig and complete the pre-use checklist:

1.2.4.1 Check the Autorock drill rig cradle:

- Check Autorock drill rig cradle and wheels for wear.
- Check the Telescopic clamping cylinders and hoses for damage or wear.
- Check the Telescopic clamping cylinder Safety Valve for damage.
- Check the Lift Cylinder and PVC drive belt for damage or wear.
- Check the drilling machine retaining key for damage, wear and proper operation by sliding the drilling machine sideways and locking it in with the locking plate.
- Check the air, water hose and couplings between the manifold, the control bank and the percussion drill for damage.
- Check that control bank and hoses is properly secured to the frame by means of the retaining straps before the unit is transported to the panel.
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1.2.5 Transport Autorock drill rig to panel:

- 1.2.5.1 The Operator to make sure that the route for the Autorock drill rig to the panel is clear of obstacles or conditions that could result in slipping, tripping or injury. Report any dangerous conditions e.g. loose hanging or sidewall, damaged support units, slippery surfaces etc. to the miner to rectify before transporting the Autorock drill rig to the panel.
- 1.2.5.2 The Operator to wear all personal protective equipment as per mine standard and it must be in good condition.
- 1.2.5.3 The Operator to pull the Autorock drill rig on its wheels close to the panel where support tendons are to be installed. The Operator must take care not to bump body parts against hanging, side wall, support units or other obstacles especially in confined spaces. Always remain within 1 meter from installed support. Do not operate in an area where temporary support units are not installed.

1.2.6 Prepare machine for drilling

NOTE: The Operator never to operate the machine with his back against the work face. He must always remain within 1M of installed support.

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1.2.6.1 The Operator to:

- Transport the Autorock the drill rig close to the first support hole to be drilled.
- Remove the hoses and control bank from the Autorock drill rig cradle, taking care not to damage any of the equipment or injuring him self.
- Place the Control Bank in a safe area between permanent support units as far as possible from the Autorock drill rig cradle and set the control bank up level on the footwall.

1.2.6.2 Connect air and water hose at panel manifold:

- Make sure that the in-line valves on the water and air hoses to be connected at the panel manifold are in the closed position.
- Connect the air and water hose to the manifold on the panel and open the valves to pressurise the hoses. Report leaks or damaged equipment on the manifold to the responsible Miner.
- On the way to the control bank, check the hoses for leaks. Leave a hose mender at each leak.



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- If there are leaks, close the air or water hose at the panel manifold and depressurise the hose/s by opening the air/water control valves at the Control Bank end of the hose. Do not remove hoses under pressure from the panel manifold.
- Flush out the air and water hose by opening the in-line valves long enough to ensure that it is clear of all possible debris and close the valves again. Warn all persons in the vicinity of your intension to flush the hoses to ensure that they can take up a safe position.
- Once the hoses are depressurised, mend all leaks on the air and water hoses prior to opening the air and water taps on the panel manifold.
- Hoses must not have more than 5 joints. When the fifth joint is made, report to the responsible Miner to replace the hose.

1.2.6.3 Check the lubricator for damage. Make sure it is clean and free from debris.

1.2.6.4 Apply Castrol Environment Oil to the lubricator. Make sure that the oil bag is clean and free from debris, to prevent debris from entering the air system

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- 1.2.6.5 Before attaching the lubricator to the Control Bank ensure that all connections are clear of debris as it will enter the air system on the machine causing blockages and damage. Blow over the drilling machine and connections with air. Attach and tighten the lubricator as tight as possible by hand.
- 1.2.6.6 Use a Stilson Wrench to tighten all connections firmly to prevent loss of compressed air.
- 1.2.6.7 Open the air hose slightly and blow off the drilling machine and all connections.
- 1.2.6.8 Close off all the air and water control valves on the Control Bank.
- 1.2.6.9 Examine the front air ports of the drilling machine and clean any blockages. Connect the air hose to the Control Bank and secure by means of a safety slings, or proper chain, secured with bolt and nut.
- 1.2.6.10 Connect the water hose to the water tube inlet on the drilling machine using a 12.5mm hose clamp. Check that the water from the water hose spurts at least 150mm vertical before connecting it up.
- 1.2.6.11 Open the air valve slowly and let the drilling machine idle for a minute or two until the lubricating oil flows visibly from the exhaust ports.

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2. Drill Support Holes

- 2.1 No holes may be drilled closer than 15cm from sockets or 2m from misfires (misfires to be treated in accordance with regulations)
- 2.2 No holes may be drilled in areas that have not been barred, made safe, and where temporary support is not installed to standard.
- 2.3 Drilling of support holes may not be carried out without the instruction of a person authorized and appointed to give such an instruction.
- 2.4 Determine the exact position to install the Autorock drill rig by means of dropping a small piece of rock from the marked support hole position onto the footwall.
- 2.5 Pull the Autorock drill rig on the cradle sides into the correct position. Never move the Autorock drill rig with your hands on the top section of the Autorock drill rig.
- 2.6 Lift the drilling machine locking plate and slide the drilling machine to the side. This will ensure that you have enough space to insert a starter jumper.
- 2.7 Check the condition of the drill bit. If the drill bit is blunt or damaged, replace it. Measure the water tube gap by inserting the water tube measuring staff into front of the rock drill and holding the mark. Hold the measure staff against the collar of the jumper and compare the difference. The distance between the jumper and the water tube must not be more than 25mm and not less than 6mm. If this is the case the machine must not be used.



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- 2.8 Position the starter jumper in the drilling machine and through the collaring device if fitted.
- 2.9 Lift the drilling machine slowly from with the drive cylinder control valve until it reaches the hanging wall.
- 2.10 Check to make sure that the jumper is lined up in the correct position at right angles to the dip of the strata.
- 2.11 Lift the clamping cylinders into position and close the safety valve. Ensure that the Autorock drill rig is secure by pulling on the cradle. If movement is detected, re-install the Autorock drill rig.
- 2.12 Open the drilling machine air valve slowly to allow the drill bit to collar the hole. Once the jumper is adequately collared, the air can be increased gradually to full strength.
- 2.13 Drill the hole until the collar of the drill steel reaches the hanging wall.
- 2.14 Close the drilling machine air valve and reduce the air on the drive cylinder valve slowly for the drilling machine to lower to the bottom.
- 2.15 Lift the locking plate on the drilling machine and slide it to the side.
- 2.16 Remove the starter jumper and insert the preferred length jumper to accommodate the support tendons to be installed.
- 2.17 Lift the drilling machine slowly until the jumper enters the hole as far as it would go.

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2.18 Repeat section 2.10 to 2.13

2.19 Remove the jumper.

3. Install support tendons.

3.1 Re-examine the hanging wall before inserting the support tendon.

3.2 Install the support tendon as per mine standard and supplier's recommendation.

3.3 Pre-tension the support tendon as per mine standard and supplier's recommendation.

3.4 Use applicable tensioning device to pre-tension support tendon to the required standard.

4. After Drilling and Installing of support tendons is completed:

4.1 Lower the drilling machine slowly to the bottom.

4.2 Re-examine hanging wall before releasing clamping cylinders.

4.3 Open the safety valve and release the clamping cylinders.

4.4 Pull the Autorock drill rig from the panel into a secure area.

4.5 Close in-line water valve.

4.6 Open up air valve on percussion machine to remove all excess water from the drilling machine.



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- 4.7 Remove air hose from the machine.
- 4.8 Position the Control Bank and hoses on the Autorock drill rig. Use the retaining straps to secure the Control Bank and hoses.
- 4.9 Transport the Autorock drill rig to a safe, dry and secure place where it will not be exposed to moving machinery or possible damage due to blasting.

Note: After support holes have been drilled, the tendons can also be fixed with cementitious pumpable or capsulated grout or in the case of Hydro Bolts, with water. The support medium will be determined by the mine's support code of practice.