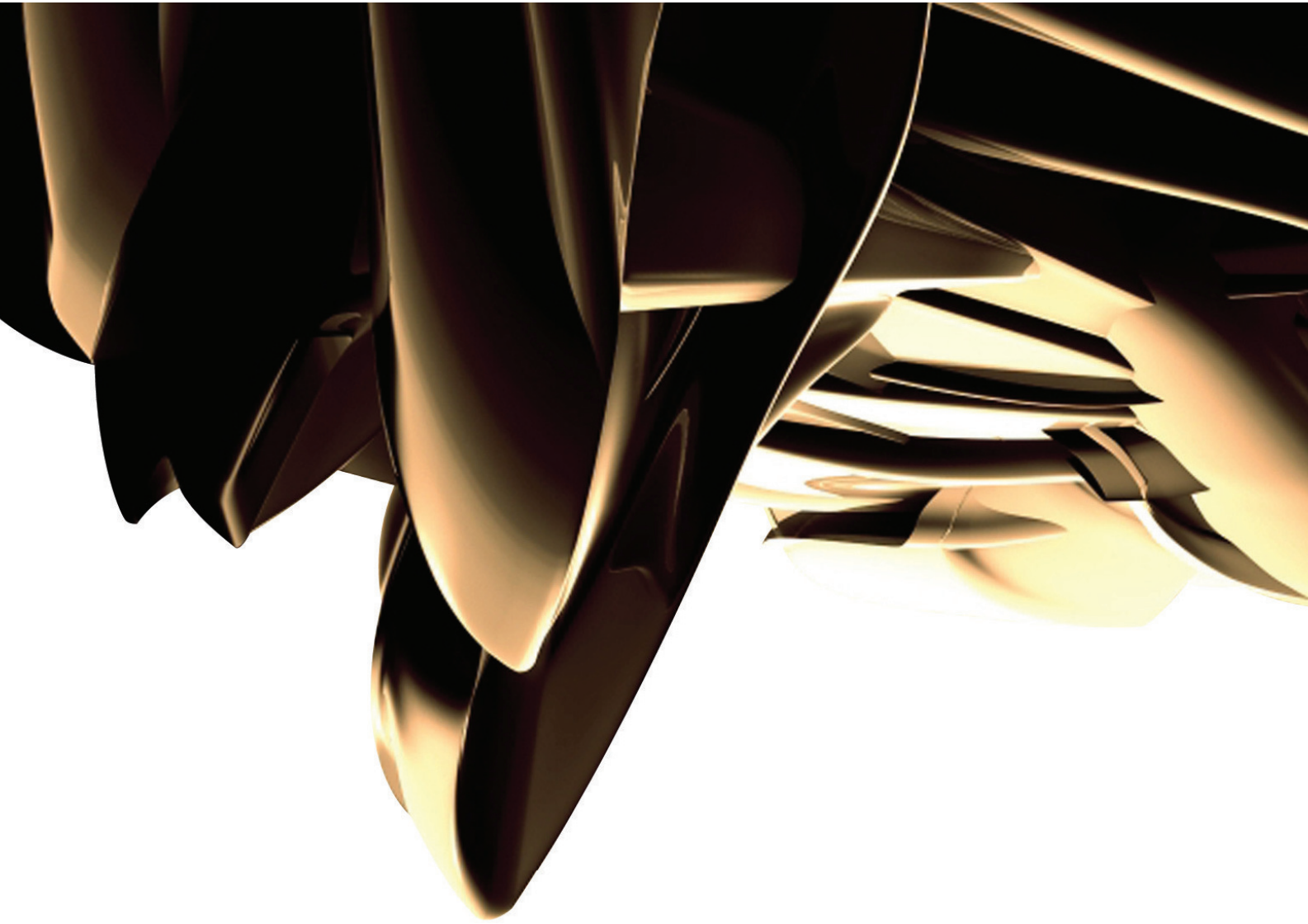


MINE HEALTH AND SAFETY INSPECTORATE



GUIDELINE

For the Compilation of a Mandatory Code of Practice for the Design, Development/Construction, Safe Operation and Maintenance of Draw Points, Tipping Points, Rock Passes and Box Fronts



mineral resources

Department:
Mineral Resources
REPUBLIC OF SOUTH AFRICA

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Chief Inspector of Mines

31 January 2011

Date



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PART A: THE GUIDELINE

1. FOREWORD

This guideline affects mines at which draw points, tipping points, rock passes and box fronts are used for the transport and transferring of rock.

Draw points, tipping points, rock passes and box fronts have been identified by the Chief Inspector of Mines as an area requiring legislation. A task group was established under the auspices of the Mine Regulations Advisory Committee to investigate the most appropriate means of legislation for this topic. After considering it was decided that the use of a guideline for a COP would be the most appropriate means of legislation for draw points, tipping points, rock passes and box fronts as it will allow for mine specific safety measures to be written into a comprehensive mine health and safety strategy.

2. LEGAL STATUS OF GUIDELINES AND COPS

- 2.1 In accordance with section 9(2) of the **MHSA** an employer must prepare and implement a **COP** on any matter affecting the health and safety of employees and other persons who may be directly affected by activities at the mine if the Chief Inspector of Mines requires it. These **COPs** must comply with any relevant guidelines issued by the Chief Inspector of Mines (section 9(3)) of the **MHSA**. Failure by the employer to prepare or implement a **COP** in compliance with this guideline is breach of the **MHSA**.

3. THE OBJECTIVE OF THIS GUIDELINE

The objective of this guideline is to enable the employer at every mine to compile a COP, which, if properly implemented and complied with, would improve health and safety in connection with the design, development, construction, operation and maintenance of draw points, tipping points, rock passes and box fronts at a mine.

4. DEFINITIONS

In this guideline for a COP or any amendment thereof the following abbreviations are used:

- 4.1 **Arching** means the natural process by which fractured rock acquires a certain amount of ability to support itself through the resolution of the vertical component of its weight into diagonal thrust.
- 4.2 **Blockage** means an obstruction of the flow of rock in a rock pass.
- 4.3 **Box front** means a structure installed at lower opening of a rock pass to control the flow of rock that includes the bulkheads, chutes, platforms, control mechanisms, cylinders and similar accessories.
- 4.4 **Bridging** means formation of arches of keyed or jammed rocks across the direction of flow.
- 4.5 **Chute** means an inclined trough through which rock falls by gravity from a higher to a lower level.
- 4.6 **Competent person**¹ means a person with Government Certificate of Competency (mechanical or electrical) or equivalent competency as may be determined by MQA.

- 4.7 **COP** means Code of Practice
- 4.8 **Dead boxes** means an excavation in a rock pass that fills with rock where the flow of rock impacts and the direction of the flow of rock is changed.
- 4.9 **Development** means a tunnelling operation.
- 4.10 **DMR** means Department of Mineral Resources
- 4.11 **Dog legs** means an abrupt change of direction of a rock pass.
- 4.12 **Draw point** means a point where the rock is loaded out or allowed to flow out from an excavation.
- 4.13 **Grizzly** means a structure at the top entrance of a rock pass to control the size of the rocks entering into the rock pass which consist of grizzly bars supported by a designed foundation.
- 4.14 **Hang-up** means broken rock lodged in a rock pass forming a blockage.
- 4.15 **MHSA** means Mine Health and Safety Act, 1996, (Act 29 of 1996).
- 4.16 **Mud rush** means a sudden uncontrolled outflow of mud, water or wet material from draw points, chutes, box fronts or any other underground workings.
- 4.17 **Professional Engineer** means an engineer registered with the Engineering Council of South Africa.
- 4.18 **Professional Technologist** means a technologist registered with the Engineering Council of South Africa.
- 4.19 **Rock** means for the purpose of this document rock includes: ore, waste rock, coal or any other minerals.
- 4.20 **Rock pass** means steeply inclined excavation used to transport and store rock between working places and transfer points.
- 4.21 **Rock pass leg** means a straight portion of a rock pass.
- 4.22 **SANS** means South African National Standard
- 4.23 **Tipping point** means the upper inlet into the rock pass.

5. SCOPE

This guideline covers the significant health and safety aspects associated with the design, development, excavation, installation, construction, operation and maintenance of draw points, tipping points, rock passes and box fronts.

6. TASK GROUP MEMBERSHIP

6.1 This guideline was prepared by the MRAC Tripartite Task Group on draw points, tipping points, rock passes and box fronts.

6.2 The members appointed were the following:

Mr W A Masztalerz	Chairperson
Mr W J M Welding	State
Mr P du Preez	State
Mr I Stocks	State
Mr J Taylor	Employers

The following persons were consulted:

Mr C Hey	Amplats
Dr K Wainwright	Amplats
Prof T R Stacey	University of Witwatersrand

PART B: AUTHORS' GUIDE

1. The COP must, where possible, follow the sequence laid out in Part C "Format and Content of the mandatory COP". The pages as well as the chapters and sections must be numbered to facilitate cross-reference. Wording must be unambiguous and concise.
2. It should be indicated in the COP and on each annex to the COP whether-
 - (a) the annex forms part of the guideline and must be complied with or incorporated in the COP or whether aspects thereof must be complied with or incorporated in the COP, or
 - (b) the annex is merely attached as information for consideration in the preparation of the COP (i.e. compliance is discretionary).
3. When annexes are used the letter allocated to that particular annex should precede the numbering and the numbering should start at one (1) again. (eg. 1, 2, 3, ...A1, A2, A3,...).
4. Whenever possible illustrations, tables, graphs and the like, should be used to avoid long descriptions and/or explanations.
5. When reference has been made in the text to publications or reports, references to these sources must be included in the text as footnotes or sidenotes as well as in a separate bibliography

PART C: FORMAT AND CONTENT OF THE MANDATORY CODE OF PRACTICE.

1. TITLE PAGE

The title page must include the following:

- name of the mine;
- the Heading: "Mandatory COP for the safe design, development, construction, operation and maintenance of draw points, tipping points, rock passes and box fronts for the transport and transfer of rock";
- a statement to the effect that the COP was drawn up in accordance with this guideline (quoting the reference number and revision date) issued by the Chief Inspector of Mines;
- the mine's reference number for the COP;
- effective date, and
- revision dates.

2. TABLE OF CONTENTS

The COP must have a comprehensive table of contents.

3. STATUS OF MANDATORY CODE OF PRACTICE

This section must contain statements to the effect that:

- 3.1 The mandatory COP was drawn up in accordance with Guideline DMR 16/3/2/2-A6 issued by the Chief Inspector of Mines.
- 3.2 This is a mandatory COP in terms of Sections 9(2) and (3) of the Mine Health and Safety Act.
- 3.3 The COP may be used in an incident investigation/inquiry to ascertain compliance and also to establish whether the COP is effective and fit for purpose.
- 3.4 The COP supersedes all previous relevant Codes of Practice.
- 3.5 All managerial instructions or recommended procedures (Voluntary COP) and standards on the relevant topics must comply with the COP and must be reviewed to assure compliance.

4. MEMBERS OF DRAFTING COMMITTEE

- 4.1 In terms of Section 9(4) of the MHSA the employer must consult with the health and safety committee on the preparation, implementation or revision of any COP.
- 4.2 It is recommended that the employer should, after consultation with the employees in terms of the MHSA, appoint a committee responsible for the drafting of the COP.
- 4.3 The members of the drafting committee assisting the employer in drafting the COP should be listed giving their full names, designations, affiliations and experience. This committee should include competent persons sufficient in number to effectively draft the COP.

5. GENERAL INFORMATION

The general information relating to the mine must be stated in this paragraph.
The following minimum information must be provided:

- 5.1 a brief description of the mine and its location;
- 5.2 the commodities produced;
- 5.3 the mining methods/mineral excavation processes;
- 5.4 a description of the draw points, tipping points, rock passes and box fronts systems used in or on the mine (including relevant information such as the application and technical specifications), and
- 5.5 other relevant Codes of Practice.

6. TERMS AND DEFINITIONS

Any term, definition or acronym of which the meaning is not absolutely clear must be clearly defined.

7. RISK MANAGEMENT

- 7.1 Section 11 of the MSHA requires the employer to identify hazards, assess the health and safety risks to which employees may be exposed while they are at work, and record the significant hazards identified and risk assessed. The COP must address how the significant risks identified in the risk assessment process must be dealt with, having regard to the requirements of Section 11(2) and (3) that, as far as reasonably practicable, attempts should first be made to eliminate the risk, thereafter to control the risk at source, thereafter to minimise the risk and thereafter, insofar as the risk remains, provide personal protective equipment and to institute a program to monitor the risk. (Annexure “A1”)
- 7.2 To assist the employer with risk assessment all possible relevant information such as incident statistics, studies, research reports, manufacturers specifications, international standards, design criteria and performance figures for the draw points, tipping points, rock passes and box fronts should be obtained and considered.
- 7.3 In addition to the periodic review required by Section 11(4) of the Act, the COP should be reviewed and updated after every serious incident involving the draw points, tipping points, rock passes and box fronts or if significant changes are introduced to procedures, mining and ventilation layouts, mining methods, plant or equipment and material.

8. ASPECTS TO BE ADDRESSED IN THE MANDATORY CODE OF PRACTICE

The COP must set out how the significant risks assessed and identified in terms of the risk assessment process referred to in paragraph 7.1, will be addressed unless there is no significant risk associated with that aspect at the mine, the COP must cover at least the aspects set out below. (Annexure “A1”)

8.1 DRAWPOINT

8.1.1 DRAWPOINT DESIGN

In order to ensure that a defensible design is produced, which provides for a safe operation and a healthy working environment, the COP must set out a description of the design strategy to be adopted by covering, at least, the following –

- A clear statement of the problem that requires design, including the expected performance objectives.
- Identification of all constraints that might impose certain requirements on the design.
- The collection and analysis of all necessary data that is required for the design.
- The competency of the person responsible for the design process
- The evaluation of alternative designs including a risk assessment of all designs.
- The definition and recommendation of all necessary monitoring devices.

8.1.2 DRAWPOINT DEVELOPMENT

In order to ensure ground stability of the drawpoint and its associated tunnels and to provide for a safe operation and a healthy working environment, the COP must set out a description of the development strategy to be adopted by covering, at least, the following –

- The correct design of drilling patterns and accuracy of drill holes
- The type of explosives and initiating systems to be used and the sequence of initiation
- The design and type of primary support required to maintain the integrity of the excavations.

8.1.3 DRAWPOINT CONSTRUCTION AND INSTALLATION

In order to provide for a safe operation and a healthy working environment, the COP must set out a description of the construction and installation strategy to be adopted by covering, at least, the following –

- Drawpoint construction and installation processes, methodology, techniques and sequences.
- The support requirements for drawpoints in different rocks and in different mining environments. Reference must be made to the relevant geotechnical environment and to the mining process and equipment to be used in that environment.
- The competency of the person responsible for the construction and installation processes.
- The competency of the person supervising the construction and installation processes.
- The competencies and skill levels of the relevant crews.
- The quality of work performed and it's compliance to approved design (refer to paragraph 8.1.1).

8.1.4 DRAWPOINT OPERATIONS

In order to prevent persons from being injured during daily operations and to provide for a safe operation and a healthy working environment, the COP must set out a description of the operations strategy to be adopted by covering, at least, the following –

- Drawpoint operational processes, methodology, techniques and sequences.
- Measures employed to monitor areas of potential ground movement.
- Measures employed to monitor and protect the integrity of all access and escape ways.

- Measures employed to monitor orebody depletion on a continuous basis so as to avoid potential incidents such as air blasts and mud rushes.
- The competencies and skill levels of the relevant crews.

8.1.5 DRAWPOINT MAINTENANCE

In order to provide for a safe operation and a healthy working environment, the COP must set out a description of the maintenance strategy to be adopted by covering, at least, the following –

- Drawpoint maintenance processes, methodology, techniques and sequences
- The competency of the person responsible for the maintenance process.
- The competency of the person supervising the maintenance process.
- The competencies and skill levels of the relevant crews.
- The quality of work performed and it's compliance to approved design (refer to paragraph 8.1.1).
- Measures employed to monitor drawpoint deterioration and repair scheduling

Annex “A2” is appended for information and reference purposes only for the design, development, construction, installation, operation and maintenance of drawpoints.

8.2 TIPPING POINTS

8.2.1 TIPPING POINT DESIGN

In order to ensure that a defensible design is produced, which provides for a safe operation and a healthy working environment, the COP must set out a description of the design strategy to be adopted by covering, at least, the following –

- A clear statement of the problem that requires design, including the expected performance objectives.
- Identification of all constraints that might impose certain requirements on the design.
- The collection and analysis of all necessary data that is required for the design.
- The competency of the person responsible for the design process
- The evaluation of alternative designs including a risk assessment of all designs.
- The definition and recommendation of all necessary monitoring devices.

8.2.2 TIPPING POINT SLIPING

In order to ensure ground stability of the tipping point and it's associated tunnels and to provide for a safe operation and a healthy working environment, the COP must set out a description of the blasting / excavating strategy to be adopted by covering, at least, the following –

- Breaking method
- Maximum and minimum size of excavation
- The design and type of support required to maintain the integrity of the excavations.

8.2.3 TIPPING POINT CONSTRUCTION AND INSTALLATION

In order to provide for a safe operation and a healthy working environment, the COP must set out a description of the construction and installation strategy to be adopted by covering, at least, the following –

- Tipping point construction and installation processes, methodology, techniques and sequences.
- The support requirements for tipping points in different rocks and in different mining environments. Reference must be made to the relevant geotechnical environment and to the mining process and equipment to be used in that environment.
- The competency of the person responsible for the construction and installation processes.
- The competency of the person(s) supervising the construction and installation processes.
- The competencies and skill levels of the relevant crews.
- The quality of work performed and it's compliance to approved design (refer to paragraph 8.2.1).

8.2.4 TIPPING POINT OPERATIONS

In order to prevent persons from being injured during daily operations and to provide for a safe operation and a healthy working environment, the COP must set out a description of the operations strategy to be adopted by covering, at least, the following –

- Tipping point operational processes, methodology, techniques and sequences.
- Measures employed to monitor areas of potential ground movement.
- Measures employed to monitor and protect the integrity of all access and escape ways.
- Measures employed to monitor quantity of rock handled and to prevent the cross tramming of ore to waste and vice versa
- The competencies and skill levels of the relevant crews.

8.2.5 TIPPING POINT MAINTENANCE

In order to provide for a safe operation and a healthy working environment, the COP must set out a description of the maintenance strategy to be adopted by covering, at least, the following –

- Tipping point maintenance processes, methodology, techniques and sequences
- The competency of the person responsible for the maintenance process.
- The competency of the person supervising the maintenance process.
- The competencies and skill levels of the relevant crews.
- The quality of work performed and it's compliance to approved design (refer to paragraph 8.2.1).
- Measures employed to monitor tipping point deterioration and the repair schedule.

Annexure “A2” is for information and reference purposes only for the design, development, construction, installation, operation and maintenance of tipping points.

8.3 ROCK PASSES

8.3.1 ROCK PASS DESIGN

In order to ensure that a defensible design is produced, which provides for a safe operation and a healthy working environment, the COP must set out a description of the design strategy to be adopted by covering, at least, the following-

- A clear statement of the problem that requires design, including the expected performance objectives
- Identification of all constraints that might impose certain requirements on the design
- The collection and analysis of all necessary data (including but not limited to dimensions, capacities, geological structure, rock properties) that is required for the design.
- The competency of the person responsible for the design process
- The evaluation of alternative designs including a risk assessment of all designs.
- The definition and recommendation of all necessary monitoring devices.

8.3.2 ROCK PASS DEVELOPMENT/ EXCAVATING

In order to ensure ground stability of the rock pass and its associated tunnels and to provide for a safe operation and a healthy working environment, the COP must set out a description of the development strategy to be adopted by covering, at least, the following -

- The correct design of drilling patterns and accuracy of drill holes
- The type of explosives and initiating systems to be used and the sequence of initiation
- The design and type of primary support required to maintain the integrity of excavations.

8.3.3 ROCK PASS CONSTRUCTION AND INSTALLATION

In order to provide for a safe operation and a healthy working environment, the COP must set out a description of the construction and installation strategy to be adopted by covering, at least, the following -

- Rock pass construction and installation processes, methodology, techniques and sequences.
- The support requirements for rock pass in different rocks and in different mining environments.
- Reference must be made to the relevant geotechnical environment and to the mining process and equipment to be used in that environment.
- The competency of the person responsible for the construction and installation processes.
- The competency of the person supervising the construction and installation processes.
- The competencies and skill levels of the relevant crews.
- The quality of work performed and its compliance to approved design (refer to paragraph 8.3.1)

8.3.4 ROCK PASS OPERATIONS

In order to prevent persons from being injured during daily operations and to provide for a safe operation and a healthy working environment, the COP must set out a description of the operations strategy to be adopted by covering, at least, the following -

- Rock pass operational processes, methodology, techniques and sequences
- Measures employed to monitor areas of potential ground movement.
- Measures employed to monitor and protect the integrity of all access and escape ways
- Measures employed to monitor ore body depletion on a continuous basis so as to avoid potential incidents such as air blasts and mud rushes.
- The competencies and skill levels of the relevant crews

8.3.5 ROCK PASS MAINTENANCE

In order to provide safe operation and healthy working environment, the COP must set out a description of the maintenance strategy to be adopted by covering, at least, the following -

- Rock pass maintenance processes, methodology, techniques and sequences.
- The competency of the person responsible for the maintenance process.
- The competency of the person supervising the maintenance process.
- The competency and skill levels of the relevant crews
- The quality of work performed and its compliance to approved design (refer to paragraph 8.3.1)
- Measures employed to monitor rock pass deterioration and repair scheduling.

Annex “A4” is appended for information and reference purposes only for the design, development, construction, installation, operation and maintenance of rock pass.

8.4 BOX FRONTS

8.4.1 BOX FRONT DESIGN

In order to ensure that a defensible design is produced, which provides for a safe operation and a healthy working environment, the COP must set out a description of the design strategy to be adopted by covering, at least, the following -

- A clear statement of the problem that requires design, including the expected performance objectives.
- Identification of all constraints that might impose certain requirements on the design.
- The collection and analysis of all necessary data (including, but not limited to dimensions, capacities, geological structure, rock properties) that is required for the design.
- The competency of the person responsible for the design process
- The evaluation of alternative designs including a risk assessment of all designs.
- The definition and recommendation of all necessary monitoring devices.

8.4.2 BOX FRONT CONSTRUCTION, INSTALLATION AND REMOVAL

In order to provide for a safe operation and a healthy working environment, the COP must set out a description of the construction, installation and removal procedure to be adopted by covering, at least, the following –

- Box front construction and installation processes, methodology, techniques and sequences.
- The support requirements for box front in different rocks and in different mining environments.
- The competency of the person responsible for the construction, installation and removal processes.
- The competency of the person(s) supervising the construction, installation and removal processes.
- The competencies and skill levels of the relevant crews.
- The quality of work performed and its compliance to approved design (refer to paragraph 8.4.1).

8.4.3 BOX FRONT OPERATIONS

In order to prevent persons from being injured during daily operations and to provide for a safe operation and a healthy working environment, the COP must set out a description of the operations strategy to be adopted by covering, at least, the following –

- Box front operational processes, methodology, techniques and sequences.
- Measures employed to monitor areas of potential ground movement.
- Measures employed to monitor and protect the integrity of all access and escape ways.
- The competencies and skill levels of the relevant crews.

8.4.4 BOX FRONTS MAINTENANCE

In order to provide for a safe operation and a healthy working environment, the COP must set out a description of the maintenance strategy to be adopted by covering, at least, the following –

- Box front maintenance processes, methodology, techniques and sequences.
- The competency of the person responsible for the maintenance process.
- The competency of the person supervising the maintenance process.
- The competencies and skill levels of the relevant crews.

- The quality of work performed and its compliance to approved design (refer to paragraph 8.4.1).
- Measures employed to monitor box front deterioration and repair schedule.

Annex “A3” is appended for information and reference purposes only for the design, development, construction, installation, operation and maintenance of box fronts.

PART D: IMPLEMENTATION

1. IMPLEMENTATION PLAN

- 1.1 The employer must prepare an implementation plan for its COP that makes provision for issues such as organisational structures, responsibilities of functionaries and programs and schedules for this COP that will enable proper implementation of the COP. (A summary of/and a reference to, a comprehensive implementation plan may be included).
- 1.2 Information may be graphically represented to facilitate easy interpretation of the data and to highlight trends for the purpose of risk assessment.

2. COMPLIANCE WITH THE CODE OF PRACTICE

The employer must institute measures for monitoring and ensuring compliance with the COP.

3. ACCESS TO THE CODE OF PRACTICE AND RELATED DOCUMENTS

- 3.1 The employer must ensure that a complete COP and related documents are kept readily available at the mine for examination by any affected person.
- 3.2 A registered trade union with members at the mine or where is no such union, a health and safety representative on the mine, or if there is no health and safety representative, an employee representing the employees on the mine, must be provided with a copy on written request to the manager. A register must be kept of such persons or institutions with copies to facilitate updating of such copies.
- 3.3 The employer must ensure that all employees are fully conversant with those sections of the COP relevant to their respective areas of responsibility.

ANNEXURES

Annexures, or references within the annexes, are marked (A) or (B) according to whether,

- (a) it forms part of the guideline and must be complied with or incorporated in the COP or whether aspects thereof must be complied with or incorporated in the COP, or
- (b) it is merely attached as information for consideration in the preparation of the COP (i.e. compliance is discretionary).

ANNEXURE “A”

REFERENCES

- 1 Simrac Report – OTH 303
- 2 SANS 10208 Part IV

ANNEXURE “A1”

RISKS ASSOCIATED WITH THE DESIGN, DEVELOPMENT / CONSTRUCTION, SAFE OPERATION AND MAINTENANCE OF DRAW POINTS, TIPPING POINTS, ROCK PASSES AND BOX FRONTS

In order to prevent accidents or situations that give rise to a multitude of incidents or accidents to persons at a mine the COP must consider the following hazards:

Air-blast	Lifting operations
At risk behaviour	Lockout procedure
Blocked pass (hang ups)	Moving machinery
Consequences of poor drilling and blasting	Mud rushes
Corrosion	Noise
Crushing against side wall	Operational clearances
Dust	Oversize excavations
Explosives accidents	Recommissioning of old rock passes
Fail to safe equipment	Scaling
Falls of ground	Scaling especially at structures
Gassing	Seismicity
Hang ups / blockages / arching	Steeply inclined excavations
Illumination	Structural failure
Incompetent ground	Vibration
Lack of expertise	Water and mud accumulation
Lack of skills and training	Water entering pass
Lack of ventilation	

ANNEXURE “A2”

THE DESIGN, DEVELOPMENT, CONSTRUCTION, SAFE OPERATION AND MAINTENANCE OF DRAWPOINTS

1. DRAWPOINT DESIGN

The design and planning of drawpoints should consider the following aspects:

1.1 Geotechnical studies

A geotechnical study of the orebody should be carried out to collect data that will allow for rock mass classification in accordance with one of the commonly recognised rock mass classification systems. Data that should be collected includes uniaxial compressive strength of the rocks, joint spacing, joint condition and stress levels. Important design and planning parameters, in particular fragmentation, mining sequence, support design caveability and caving radius, should be derived from this study.

1.2 Numerical modeling

Numerical modeling is a useful design and planning tool and should be considered as it defines areas of potential high stresses (and possible failures) that may / will impact on designed mining layout and mining sequences. The parameters needed for stress modeling must be derived from the geotechnical evaluation and rock mass classification.

1.3 Ellipsoid of draw

The draw ellipsoid of a particular fragmented rock will have a significant impact on drawpoint design. Drawpoint size and spacings will be affected by the interaction between adjacent draw ellipsoids.

1.4 Drawpoint spacings

The size of a drawpoint is a function of rock mass strength and the support requirements. The height of a drawpoint is a function of rock mass strength and will determine the rill distance from the brow.

2. DRAWPOINT DEVELOPMENT AND EXCAVATION

The development of the drawpoint and its associate crosscut is important for the optimal operation of the mining block. Therefore, cognizance should be taken of properly designed and detailed development rounds and the drilling thereof. This is necessary to ensure that;

- The bullnose and camelback are not damaged during development.
- The drawpoint brow area is not damaged and that the required support can be installed.
- The distances across the major apices are developed according to design.
- Overbreak is minimized with minimal effect on support quality.

3. DRAWPOINT CONSTRUCTION AND INSTALLATION

Drawpoint construction is essentially a support operation and needs to be done in accordance with the operation's procedures. This should clearly specify the support requirements for drawpoints in different rock types and different mining environments.

Drawpoint installation is a skilled operation and should be done in accordance with a procedure approved by the mine, which includes details of, but not limited to, the skills level requirements of the installation crew, approved engineering drawings (refer to paragraph 8.1.1) and quality control.

4. OPERATIONS AND TRAINING

The risks associated with massive mining need to be understood by those persons involved with such operations. As a result drawpoint operations should be governed by approved procedures that address the:

4.1 Mining sequence

A system should be developed on mine that ensures that the designed mining sequence is adhered to, in particular the relationships between drawpoint development, drawpoint installation, trough opening and undercut face position.

4.2 Draw control

A draw control system and strategy should be developed prior to any ore production through the drawpoints. This strategy should address issues such as draw rate, trough opening, waste ingress and rock state.

4.3 Secondary drilling and blasting

A secondary drilling and blasting system should be readily available so that hang-ups – be they high or low – can be blasted and cleared. Lack of availability of drawpoints can impact on the draw control plan and production targets. Procedures and risk assessments should cover drilling, charging and blasting various types of hang-ups as well as the operation of the associated vehicles and equipment.

4.4 Drawpoint rehabilitation

Mining operations and mining induced stress changes impact on the strength of the rock causing deterioration, in particular drawpoint brows and bull noses.

4.5 Cave monitoring

Cave monitoring (and cave back propagation) should be undertaken continuously to avoid incidents such as air blasts and mud rushes. The continuous monitoring will provide early warning on potential caving problems that could impact on safety and production.

4.6 Training

Laid down procedures including risk assessments should be developed to train all relevant personnel who undertake loading, secondary drilling and blasting and rehabilitation work.

ANNEXURE “A3”

THE DESIGN, DEVELOPMENT, CONSTRUCTION, SAFE OPERATION AND MAINTENANCE OF TIPPING POINTS

1. TIPPING POINT DESIGN

The design and planning of tipping points should consider the following aspects:

1.1 Geotechnical studies

A geotechnical study of the orebody should be carried out to collect data that will allow for rock mass classification in accordance with one of the commonly recognised rock mass classification systems. Data that should be collected includes uniaxial compressive strength of the rocks, joint spacing, joint condition and stress levels. Important design and planning parameters, in particular fragmentation, mining sequence, support design caveability and caving radius, should be derived from this study.

1.2 Numerical modeling

Numerical modeling is a useful design and planning tool and should be considered as it defines areas of potential high stresses (and possible failures) that may / will impact on designed mining layout and mining sequences. The parameters needed for stress modeling must be derived from the geotechnical evaluation and rock mass classification.

1.3 Dynamics of operation

The shock forces of hoppers being tipped or scrapers delivering rock should be considered. Secondary breaking of rock needs to be considered to take into account blasting vibrations.

1.4 Grizzly bar opening size

Openings of grizzly bars are a function of the system capability to handle the maximum size rocks from this point through the mine's transport system as well as the oversized fraction likely to occur and the secondary breaking techniques.

2. TIPPING POINT DEVELOPMENT AND EXCAVATION

The development of the tipping point and its associate filter chamber is important for the optimal operation of the mining block. Therefore, cognisance should be taken of properly designed and detailed development rounds and the drilling thereof. This is necessary to ensure that;

- The bullnose and camelback are not damaged during development.
- The distances across the major apices are developed according to design.
- Overbreak is minimized with minimal effect on support quality.

3. TIPPING POINT CONSTRUCTION AND INSTALLATION

Tipping point construction is essentially a support operation and needs to be done in accordance with the operation's procedures. This should clearly specify the support requirements for tipping points in different rock types and different mining environments.

Tipping point installation is a skilled operation and should be done in accordance with a procedure approved by the mine, which includes details of, but not limited to, the skills level requirements of the installation crew, approved engineering drawings (refer to paragraph 8.2.1) and quality control.

4. OPERATIONS AND TRAINING

The risks associated with massive mining need to be understood by persons involved with such operations. Further, tipping point operations should be governed by procedures that address at least the following;

4.1 Mining sequence

A system should be developed on mine that ensures that the designed mining sequence is adhered to, in particular the relationships between tipping point development, tipping point installation, trough opening and undercut face position.

4.1 Draw control

A draw control system and strategy should be developed prior to any ore production through the tipping points. This strategy should address issues such as draw rate, air blast, waste ingress and rock state.

4.2 Secondary drilling and blasting

A secondary drilling and blasting system should be readily available so that hang-ups – be they high or low – can be blasted and cleared. Lack of availability of tipping points can impact on the draw control plan and production targets. Procedures and risk assessments should cover drilling, charging and blasting various types of hang-ups as well as the operation of the associated vehicles and equipment.

4.3 Tipping point rehabilitation

Mining operations and mining induced stress changes impact on the strength of the rock causing deterioration, in particular tipping point brows and bull noses.

4.4 Draw monitoring

Draw monitoring should be conducted continuously to avoid incidents such as; air blasts and mud rushes. The continuous monitoring will provide early warning on potential blockages, arching, bridging *etc.* problems that could impact on safety and production.

4.5 Training

Laid down procedures including risk assessments should be developed to train all relevant personnel who undertake loading, secondary drilling and blasting and rehabilitation work.

ANNEXURE “A4”

THE DESIGN, DEVELOPMENT, CONSTRUCTION, SAFE OPERATION AND MAINTENANCE OF ROCK PASSES

1. Design

The design of rock passes should include specific consideration of the following aspects:

1.1 Location of passes

Locations of passes should be chosen to avoid poor rock if possible. If this is not possible, lining may be necessary.

1.2 Orientation of passes with respect to geological structure

Rock failure in passes occurs more readily for some orientations with respect to the geological structure than for others. In stratified rock masses, passes should be oriented to intersect the strata as near to perpendicular as possible.

1.3 Orientation of passes with respect to stress

In high stress conditions, the best pass orientation with respect to the stresses is sub-parallel to the maximum principal stress. If other factors allow, this orientation should be used if it is suitable.

1.4 Size of pass

The risk of hang-ups due to rock arching is a function of the size of the pass with respect to the size of the rock blocks being passed. If the material being passed contains more than 20% fines, the risk of cohesive arching is present. A recommended pass size is at least 5 times the size of the largest rock fragment being passed.

1.5 Inclination of pass

The effects of pass inclination are summarized in the following Table. The minimum recommended inclination is 55 °, which is applicable for dry ore, which flows well. In general, pass inclination should be greater than 60°, and even steeper if wet fines are present.

PARAMETER	STEEPER INCLINATION	SHALLOWER INCLINATION
Velocity of rock	Higher. Rocks bouncing against walls can cause damage	Lower
Impact	High. Can cause compaction	Low. Impact for vertical passes can be about 4 x that for 50° passes
Wear	Lower. Only impact damage due to velocity	Higher due to sliding of material on footwall
length	Shorter	Longer for the same vertical interval
Hang-ups	Less likely. High compaction main adverse effect	More likely. Slower movement of ore, accumulation of material (particularly 'sticky'), greater length, are main adverse effects.

1.6 Length of passes

The longer the pass, the more likely it is to have problems, owing to the greater extent of rock mass traversed, the greater velocities that material can attain, and, the greater difficulty of access to clear a hang – up or blockage and when rehabilitation is required.

1.7 Method of excavation

The comparative effects of boring and drill and blast excavation are given in the following Table. Roughening of bored passes reduces velocities and increases the pass size. Blasted passes tend to be larger than bored passes for the same requirement.

PARAMETER	BORED EXCAVATION	DRILL & BLAST EXCAVATION/ ROUGHENED BORED PASSES
Stability	Better, due to smooth cutting action	Worse, due to blast damage, drilling inaccuracy
Flow of rock	Fast – greater compaction and wear	Slower – greater possibility of accumulation of material
Hang-ups	Less likely for the same pass size. Compaction is an adverse influence	More likely for the same size

1.8 Control of water in passes

Water entering passes from whatever source is adverse, since formation of “sticky” rock is likely, the risk of hang-ups and mud rushes is increases, and, the flow of rock is affected. Uncontrolled inflow of water should therefore be prevented.

1.9 Pass system geometry

The geometries of dog legs, bends and branch intersections are important, since they are locations subject to wear, impact and slowing of material flow. A small included angle results in greater impact, greater potential for accumulation of material, and greater slowing of rock flow and such bends are therefore more likely locations for hang-ups. Experience suggests that included angles of $>120^\circ$ should be used. Sizes of branches and main passes must ensure that constriction does not occur.

1.10 Methods of support of passes

Support is not usually installed in passes. However, the risk of deterioration of passes, hang-ups and blockages may be reduced by implementing support – rock reinforcement, shotcrete, concrete or steel lining – or a combination of these measures. Rock support will require specific design considerations. ‘Support’ and steel items in particular are ‘foreign material’ which, when worn and loosened, can be the cause of hang-ups.

2. Development / excavating

In order to prevent accidents or situations that give rise to a multitude of incidents or accidents to persons at a mine the COP must consider the following hazards:

- Explosive accidents
- Incompetent ground
- Oversize excavations
- Steeply inclined excavations
- Lack of ventilation
- Lack of skills and training
- At risk behaviour

These hazards and associated risks can be eliminated or mitigated by appropriate development and excavating procedures and must be addressed in the COP.

3. Operation / Training

In order to prevent accidents or situations that give rise to a multitude of incidents or accidents to persons at a mine the COP must consider the following hazards:

- Mud rushes
- Consequences of poor drilling and blasting
- Explosive accidents
- Crushing against side wall
- Water entering pass
- Oversize excavations
- Blocked pass (hang ups)
- Scaling especially at structures
- Lack of ventilation
- Lack of skills and training
- At risk behaviour

These hazards and associated risks can be eliminated or mitigated by appropriate operation and training procedures as dealt with below and must be addressed in the COP.

3.1 Controlled and uncontrolled pass operation

Advantages and disadvantages of controlled and uncontrolled passes are summarized in the Table below. To minimize the risk of hang-ups, material should be drawn to keep the rock column moving. This is particularly important if water is present. This will prevent the consolidation of the material in the pass as far as possible.

	CONTROLLED PASSES	UNCONTROLLED PASSES
Advantages	Confinement by rock material in pass promotes pass stability. Reduced impact wear. Reduced scaling. Reduced effect of seismicity. Collapses minimized. Impact compaction reduced.	Reduced risk of block arch hang-ups. Reduced risk of sticky ore hang-ups. Access from top down if necessary
Disadvantages	Hang-up risk due to block arching increased. Hang-up risk due to sticky ore compaction increased Increased 'full pass' hazard when clearing hang-ups	Reduced stability since no confinement of pass walls. Scaling and collapse risk increased. Impact wear. Impact compaction increased. Potential damage to box fronts and chutes.

3.2 Methods of clearing hang-ups and blockages

If a hang-up has been located, the alternative ways in which it can be cleared must be carefully considered. In clearing hang-ups using explosives, it is the concussion that is usually relied on to loosen the hang-ups. The use of explosives may damage the walls of the pass, which can produce geometry changes or roughness that can be the nuclei for further hang-ups. The use of water to clear hang-ups in passes can be dangerous since it may lead to mud rushes, and must therefore be carefully controlled.

4. Maintenance/Training

In order to prevent accidents or situations that give rise to a multitude of incidents or accidents to persons at a mine the COP must consider the following hazards:

- Incompetent ground
- Steeply inclined excavations
- Blocked pass (hang-ups)
- Scaling especially at structures
- Lack of ventilation
- Lack of skills and training
- At risk behaviour

These hazards and associated risks can be eliminated or mitigated by appropriate maintenance and training procedures as dealt with below and must be addressed in the COP.

4.1 Monitoring and inspection of rock passes

Scheduled inspections of passes by visual or remote means are recommended to identify possible deterioration and the frequency of inspection to be determined by risk assessment.

4.2 Methods of rehabilitation of failed passes

Alternative pass rehabilitation options exist, and the implications of each must be carefully considered with regard to design and operation of the pass.

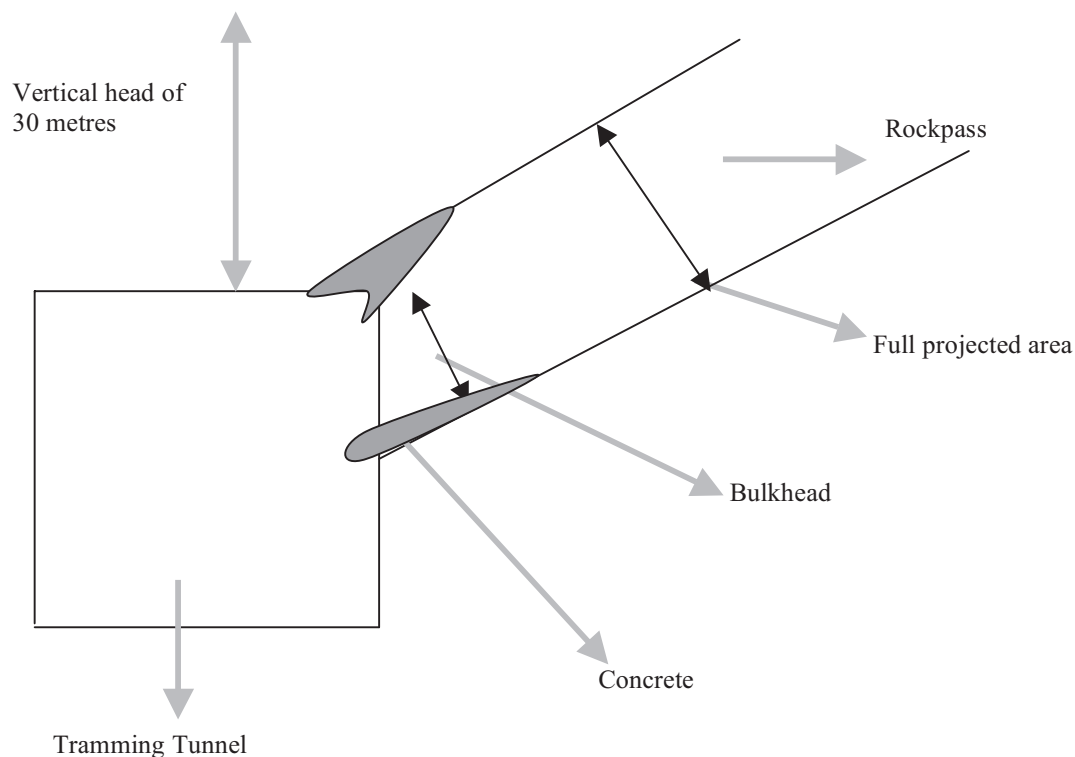
ANNEXURE “A5”

THE DESIGN, DEVELOPMENT, CONSTRUCTION, SAFE OPERATION AND MAINTENANCE OF BOX FRONTS

1. BOX FRONT DESIGN

The design of the box fronts should consider at least to the following issues;

- a) Conceptual formulation of the design, i.e. a conceptual model.
- b) Design analyses and calculations, including the basis for the design in terms of design criteria, required factor of safety (or probability of failure).
- c) In the design of bulkheads cognisance must be taken of the vertical height, the specific gravity of the material and the area of opening. History has indicated that the minimum force that the box front structure should be designed to withstand should be calculated from the full projected area rock opening of the boxhole on the bulkhead. The pressure is the product of maximum specific gravity of the slurry by the vertical height of the box hole by gravitational acceleration. A factor of safety of 1,4 has been found to be sufficient. A maximum head of 30m has been found to apply for typical rock passes dipping at no more than 80 degrees. For longer boxholes a silo effect probably comes into effect and full hydrostatic pressures are not encountered due to friction on the sidewall and doglegs. Overbreak at the entrance to a box hole should be avoided as 50% overbreak results in two and quarter times the force on a box front resulting in double the steel requirements.
- d) Evaluation of alternative designs and optimisation as required, and a risk assessment of the designs.
- e) Recommendation and implementation, and definition of monitoring measures.
- f) Double radial door chutes are available in the industry that limit spillage and in the event of a mud rush will shut off immediately. The high flow past the doors is designed so as to flip the door over and shut.
- g) Safe positions to stand during discharge of a chute is remotely (preferred position) on track level no closer than 15m taking cognisance of dip, dead-ends and ventilation flow or on the platform out of the line of discharge. Persons not involved with the drawing off of rock should stay at least 30m from the operation
- h) Controls should be designed to close off automatically if released i.e. a dead man's hand type control.



Sketch for point (c) (not to scale)

When generic designs are available the choice of the design to be implemented must take into account duty requirements of the specific installation should include the following but not limited to: height of the fall of the rocks, the ground condition, excavation geometry and rock characteristics.

Design of steelwork will be done in accordance with recognised standards and will be presented on an approved drawing available at the mine or works.

Designs are to be approved by a competent person as required by the regulations.

All steelwork including bolts or fasteners, brackets, beams, and supports, requiring replacement, must be done, in accordance with the stipulated design parameters.

The design must ensure a safe and ergonomic control, operation and maintenance of the chute or box front.

The design must specify the minimum clearance for the persons, for safe travelling at the box front and when loading operations take place.

2. CONSTRUCTIONS, INSTALLATION AND REMOVAL OF BOX FRONTS

- 2.1 The competent person¹ must ensure that the construction and installation of the chute and box front structures are carried out in accordance with the approved design.

- 2.2 Inspection and test records of the construction process must be compiled and kept for the life of that box front.
- 2.3 The box front or chute may not be put into service before the compliance certificate has been issued by the competent person¹.

3. OPERATION / TRAINING

The employer must address the mode of operation and the safe operational position of the operators during the operations of the feed chutes to provide a safe workplace under all circumstances.

To ensure safe operations in the following steps should be consciously addressed but not limited to:

3.1. **Access** – procedure regarding access of the train and positioning for loading

- Ensure the working place is clear of persons
- Ventilation requirements
- Drainage and water handling
- Clearances to both sidewalls
- Machinery clearances and operators clearances
- Signalling arrangements
- Safety of hanging and sidewalls
- Escape route

3.2. **Operational issues** to be considered:

- Access to platform.
- Platform handrails, hand rails and guards.
- Headroom to operate on platforms.
- Condition of box fronts and platform for blast damage and excessive spillage.
- Availability of equipment.
- Personal Protective Equipment.
- Excessive water issuing from the rock pass.
- Knowledge of safety instructions, actions and procedures.
- Blasting procedures.
- Where stoping method necessitates excessive water usage operate the box front remotely.
- Illumination.
- When opening chutes no person to be in line with the flow of rock.
- Manipulate rock flow by moving radial door in small movements.
- Minor blockages/hang-ups loosen with pinch bar or other suitable tool - not held rigidly and not held in line with the body but to the side.
- Water and large hang-ups.
- Rock passes without grizzly to be trammed under supervision of a competent person(s) according to a written procedure.
- No person to stand behind loaded hopper.

4 BOX FRONT MAINTENANCE

- The employer must ensure that regular inspection, audits and maintenance are done at prescribed intervals determined by the risk assessment and recorded. These records to be kept for the life of the box fronts.
- All box fronts must be identified and the locations must be recorded.
- The following points for maintenance should be addressed:

- Maintenance permission procedure is applied
- Lockout procedure,
- Ventilation and gas testing procedure,
- Cutting and welding procedures,
- Certificate of compliance after completion of maintenance,
- Testing the operating mechanisms, and
- Opening and closure of rock-passes at box fronts.

Examples of checklists are attached in Annexure B.

ANNEXURE “B1”

MAINTENANCE EXAMINATION CHECK LIST

SHAFT: _____ SECTION: _____ WORKING PLACE: _____

DATE: _____

No	ITEM	FOREMAN SIGNATURE
1	Hanging wall, sidewall barred and made safe by competent “A” person	
2	Stop signs, warning signs, sprags in place	
3	Platform	
4	Platform barricade	
5	Yellow warning signs displayed on platform barricade	
6	H – frame condition	
7	Stope chute bolts and nuts all in place, secure, type 8.8 high tensile steel	
8	Stope chute body undamaged	
9	Crevice in order	
10	Compressed air cylinder	
11	Compressed air leaks	
12	Compressed air cylinder attachment points	
13	Condition of compressed air hoses, fittings and suspension	
14	Record of installation and maintenance of chute	
15	Ladder to platform – secure, clearance to rolling stock (500mm)	
16	Rail mat or ball & chain condition	
17	Rail mat or ball & chain crossbar condition	
18	Concrete condition	
19	Steelwork condition (visible steel)	
20	Remarks:	

ENGINEER: _____

DATE: _____

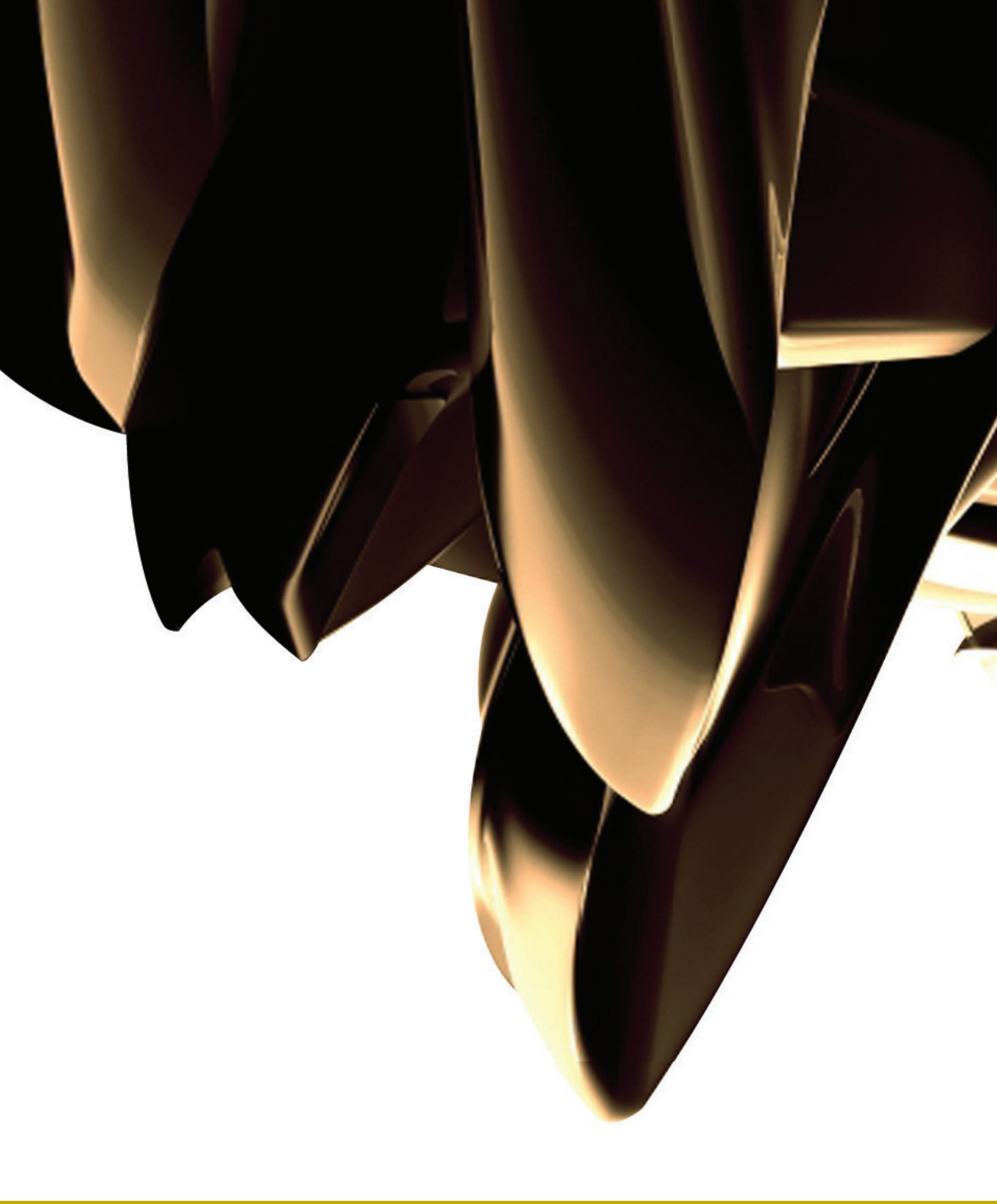
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ANNEXURE “B2”

FITTER’S MONTHLY CHUTE CONTROL MAINTENANCE CHECK LIST

SECTION: _____ LOCATION: _____ C = Checked and in order R = Repaired and checked
X = Not in order, waiting spares

No	ITEMS TO BE INSPECTED DURING MONTHLY EXAMINATIONS	DATE				
	CYLINDER CONTROLS (if applicable)					
1	Position of controls – unobstructed, no fouling					
2	Lubricator filled					
3	Filter clean					
4	Hose clamps and connections secure					
5	No air leaks					
6	Control handle condition					
7	Lockout procedure in order					
	CYLINDER					
8	Connection to studs secured					
9	No Air leaks at spuds					
10	Shaft condition – no rust or damage					
11	Shaft seals not leaking					
12	Clevis condition					
13	Clevis pin and attachments					
	CHUTE					
	Side plate position					
	Chute to H-frame – top, left and right					
	General condition of chute					
	Fitter					
	Signatures..... Foreman					
	Engineer					



mineral resources

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Mineral Resources
REPUBLIC OF SOUTH AFRICA