

# CME1 – Mechanical engineering practices applicable to underground coal mines CANDIDATE NUMBER: (write in from your letter)

## MECHANICAL ENGINEERING MANAGER OF UNDERGROUND COAL MINES EXAMINATION FOR CERTIFICATE OF COMPETENCE

Issued under the Work Health and Safety (Mines and Petroleum Sites) Regulation 2022

Unless otherwise stated all references to Act and Regulations are to the Work Health and Safety Act 2011

Work Health and Safety Regulation 2017

Work Health and Safety (Mines and Petroleum Sites) Act 2013

Work Health and Safety (Mines and Petroleum Sites) Regulation 2022

This Examination is held in the following location:

Region: New South Wales Venue: Tocal College Room: McFarlane Court

**Date:** 31 July 2024 **Start time:** 08:50:00 **Finish time:** 12:00:00

#### **INSTRUCTIONS TO CANDIDATES:**

10 minutes reading time is allowed prior to the start of the examination.

It is expected that candidates will present their answers in an engineering manner, making full use of diagrams, tables, and schematics as appropriate, and showing full workings in calculations. **Poor legibility in diagrams and handwriting** may affect the candidate being deemed competent.

Provide answers in point form wherever appropriate. If you are unable to fit your answers in the available space use the three (3) blank pages included at the end of the paper. Ensure the question you are answering is clearly marked.

All ten (10) questions are to be attempted. All questions are of equal value.

Candidates will be marked, and determined as competent, or not yet competent. If a question is identified as **ESSENTIAL**, then then the candidate must be deemed competent in that question in order to be deemed competent in the exam. If a part of a question is identified as **ESSENTIAL**, then the candidate must be deemed competent in that part in order to be deemed competent in that question and the marks for that question to be counted.

This examination is a **closed book** examination and no reference material may be used during the exam. Reference material will be provided in the exam paper as applicable.

## **EXAMINATION BOOKLET**

	estion mber	Essential	Competent / not yet competent	Mark	Assessed by Name	Comments to justify, as necessary
	Α					
	В					
1	С					
-	D					
	E					
	Total			/ 25		
	Α					
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	С					
2	D					
	E					
	F					
	Total			/ 25		
	Α					
3	В					
	Total			/ 25		
	Α					
	В					
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	E					
	Total			/ 25		

	Α		
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	Α		
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6	С		
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	Total	/ 25	
	Α		
	В		
7	С		
	D		
	E		
	Total	/ 25	
	Α		
	В		
8	С		
	D		
	Total	/ 25	

	Total		/ 25	
	F			
	E			
10	D			
	С			
	В			
	Α			
	Total		/ 25	
	F			
	E			
9	D			
	С			
	В			
	Α	Essential		

If marking is reviewed under approved processes, then examiner is to record details:

Date	Examiner	Questions reviewed	Marks changed	Details/justification, as necessary
Eg. 2/8/19	Andrew Palmer	All	Q1 – 4 (previously 5)	Found one more criteria



#### CME1 – Mechanical engineering practices applicable to underground coal mines

#### Question 1 – Shaft sinking winder

Your Mine has commenced a project to install two new shafts using conventional drill and blast sinking. The 420 metre deep shafts are a 6 metre finished diameter upcast ventilation shaft, and an 8 metre finished diameter intake and personnel access shaft. The collars are installed, and the initial 50 metre presinks are almost complete using an excavator and crane mounted kibble, with a second crane fitted with work box for access. The shaft sinking Contractor proposes to use a double drum stage winder and a single drum kibble winder for the shaft sinking.

A. Sketch a typical shaft sinking winder configuration with sufficient detail to label your drawing identifying ten (10) main components.12 marks

	How is a stage typically configured for the various activities required shaft sinking? Identify five (5) task areas and their associated composite to the various activities required shaft sinking?	
	configuration.	5 marks
C.	What are the primary functions of the kibble winder?	2 marks

3 mar	ks
What applications must be made to the Resources Regulator in relation to the installation use of a shaft sinking winder by the mine or shaft sinking contractor?  3 mar	

Question 2 – AS3584.2 Diesel Engine Systems – Explosion Protected	
You are the statutory Mechanical Engineering Manager at an underground coal mine, and you Explosion Protected Diesel Engine System Standard of Engineering Practice (SEP) refers to AS3584.2 Diesel engine systems for underground coal mines Part 2: Explosion protected.	r
A. In your own words what is the definition an explosion protected diesel engine system     5 ma	rks
	/ 5
B. What components are included in a diesel engine system? List five (5) of the seven iter	ne
5 ma	
	/ 5

AS3584.2 Section 2 Design and Construction, identifies that engines shall be compression ign diesel fuelled and water cooled types. However, they may be naturally aspirated, turbo charge supercharged.	
C. What suitable sampling points shall be provided to allow monitoring? List five (5). 5 ma	rks
	/ 5
D. The temperature of any surface that comes into contact with the atmosphere shall not enter what under any condition of operation, including when tested 1 ma	
	/ 1
What engine shutdown systems shall be fitted to an explosion protected diesel engine shall be fitted to an explosion protected diesel eng	•
	/5

F.	Draw an open joint for an explosion protected engine.	4 marks
		/ 4

#### Question 3 - Multiple choice and Short answer

Part A – Multiple Choice – identify the most appropriate answer(s). No marks awarded for an individual question if any incorrect answer is given 15 marks

- A. Which Australian Standard would you consult for fixed platforms, walkways, stairways and ladders:
  - i. AS1418
  - ii. AS1657
  - iii. AS4024
  - iv. AS4100
- B. The minimum width of a walkway should be equal to or greater than:
  - i. 500mm
  - ii. 550mm
  - iii. 600mm
  - iv. 750mm
- C. Rung type ladders are used when the angle to the horizontal is:
  - i. between 45 and 60 degrees
  - ii. between 60 and 70 degrees
  - iii. between 70 and 90 degrees
  - iv. over 90 degrees
- D. The hand rail of a walkway shall be a vertical height of:
  - i. Not less than 500mm, and not more than 700mm
  - ii. Not less than 600mm, and not more than 800mm
  - iii. Not less than 800mm, and not more than 1000mm
  - iv. Not less than 900mm, and not more than 1100mm
- E. The gap between the toeboard and the floor of a walkway should not exceed:
  - i. 10mm
  - ii. 15mm
  - iii. 20mm
  - iv. 25mm
- F. When considering the operational design of reclaim tunnels which of the following standards and/or guidelines should you refer to:
  - i. AS4024 Safety of machinery series of standards
  - ii. MDG1032 Prevention and early detection and suppression of fires
  - iii. MDG25 –Safe cutting and welding operations at mines
  - iv. MDG29 Guideline for the management of diesel engine pollutants in underground environments
  - v. All of the above

- G. Which of the following should be considered a risk control for the safe operation of reclaim tunnels
  - i. A system to control the entry of people to the reclaim tunnel and indicate when the tunnel is occupied
  - ii. Use of FRAS conveyor belting and accessories
  - iii. Emergency lighting and communications rated for safe operation in explosive atmospheres
  - iv. Ventilation of all parts of the reclaim tunnel to control airborne dust and prevent accumulation of gas or other airborne contaminants
- H. Which of the following risk control measures would NOT be considered appropriate to prevent a potential dozer engulfment in the reclaim draw point
  - i. GPS in dozer cab with proximity alarm
  - ii. Flashing light on conveyor gantry indicating active draw point
  - iii. Spotter on conveyor gantry with two way radio to dozer operator
  - iv. Heavy duty grizzly cage over the coal valve
- I. Which of the following risk control measures would eliminate a potential dozer engulfment in the reclaim draw point?
  - i. Remote autonomous dozer control
  - ii. Heavy duty grizzly cage over the coal valve
  - iii. Bucketwheel reclaimer
  - iv. Rill tower
- J. What does the term freeboard refer to with respect to belt conveyors?
  - i. Distance the pulley shell is wider than the conveyor belt to allow for belt misalignment
  - ii. Distance fixed steel work is away from the edge of the conveyor belt to prevent contact during belt wander/misalignment
  - iii. The waiving of rental cost for tenants to live in the conveyor gantry
  - iv. Distance the belt is wider than the conveyed product to prevent lumps rolling off the side
- K. What method(s) could you use to increase tension in a belt conveyor fitted with a gravity tower?
  - i. Increase the mass of the counterweight
  - ii. Increase the number of reeves of wire rope between the counterweight and LTU trolley
  - iii. Increase the height of the gravity tower
  - iv. Increase the installed power in the conveyor drive
- L. What factors influence the braking capacity of rubbered tyred mobile plant?
  - i. Tyres with aggressive tread pattern
  - ii. Increasing brake system pressure
  - iii. Decreasing load carrying capacity
  - iv. Dust suppression watering on roads
  - v. All of the above
- M. How is the park brake applied in a truck Maxibrake system where air pressure is generated and stored in a reservoir?
  - i. Air applied, hydraulic release
  - ii. Air applied, spring release
  - iii. Spring applied, air release
  - iv. Hydraulic applied, air release

	ne service brakes applied in a truck Maxibrake system where air pressure is gen in a reservoir?	erated	
and stored i.	Air applied, hydraulic release		
i. İİ.	Air applied, spring release		
iii.	Spring applied, air release		
iv.	Hydraulic applied, air release		
IV.	Tryuraulic applied, all Telease		
O. Hydraulic b	orake systems rely on what factor(s) to correctly apply?		
i.	Disc rotor not contaminated with oil, grease, or brake fluid		
ii.	Brake pads have sufficient contact area of friction material		
iii.	Air is bled out of the hydraulic lines		
iv.	Master cylinder and calliper piston seals are not leaking		
V.	All of the above		
			/ 15
Part B – Sho	ort Answer – winding systems 10 r	narks	
a) Would vo	ou expect to see a balance rope on a slope haulage winder?		
.,,	a expect to each a selection of a crope meaning of minaters		
b) what is ti	he purpose of a balance rope?		
			_
			_
c) How man	ny hoist ropes are there on a double drum winder?		
d) Name two	o types of brakes that can be fitted to the control car of a slope haulage winder?	)	
			_
			_
a) Mhat is th	ha function of a Kan?		
e) what is ti	he function of a Kep?		
			_
			_

/ 10

#### **Question 4 – Fire suppression**

You are the Statutory Mechanical Engineer at a Coal Mine and have just been advised a fire has occurred in the engine bay of a Cat D10T dozer on the edge of the stockpile. The operator has called the emergency, then tried to activate the fire suppression system (FSS), but the activator valve and panel cover have separated from the mounting bracket when trying to withdraw the safety pin.

It was a very similar type of incident to that identified in NSW Resources Regulator Safety Alert SA22-06 Operator unable to activate fire suppression system during emergency, as shown below, and your mine's dozer driver has ended up exiting the cab through the right hand side with flames licking through the deck plate, and has been forced to jump the three (3) metres to the stockpile below. Both bones in the dozer drivers left lower leg have broken in the fall.

The site emergency response team have extinguished the fire, and the dozer driver has been taken by ambulance to hospital.



Date: October 22

#### Operator unable to activate fire suppression system during emergency

This safety alert provides safety advice for the NSW mining industry.

#### Issue

When a fire occurred on a dozer, the operator tried to activate the fire suppression system when the panel cover separated from the mounting bracket, forcing the operator to abandon the plant.





#### Circumstances

A Caterpillar D10T bulldozer was operating at an open cut coal mine when a fire occurred in the engine bay. The operator saw smoke and flames and tried to activate the fire suppression system, but the valve and panel cover separated from the mounting bracket when trying to withdraw the safety pin.

Not knowing if the system could still be activated, the operator reversed a short distance, lowered the access ladder and pressed the red emergency button. With flames licking up through gaps around the deck plate, the operator exited the cabin via the left-hand door and jumped from the

deck about 3 metres to the ground. The operator was not injured and went to the rear of the machine to shut down the engine down. The fire suppression system then activated automatically.

A. Identify four (4) potential clauses / descriptions you will consider notifying the Regulator under.

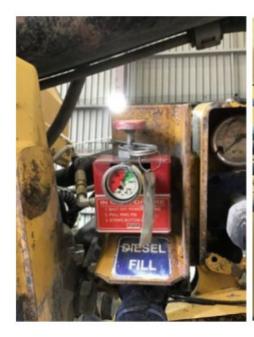
4 marks

/ 4

Refer to the additional photos of the FSS below to assist with your the following two questions.







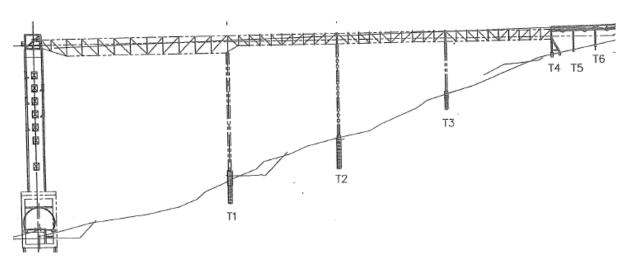


B.	Consider the fire suppression system identified in SA22-06. Describe the suppressant to and activation method.	
C.	For the system in SA22-06 above describe in detail the operational functionality of the F Suppression System (FSS) as fitted and when operated. Basically, how is it designed to 5 mar	Fire work?
		/ :
	are a number of types of fire suppression system available to the mining industry.  Describe in detail the functionality of two (2) other types of mobile equipment Fire Supp Systems (FSS's).  8 mar	

	/ 8
<ul><li>E. Describe the advantages and disadvantages of three (3) readily available mobile ed</li><li>Fire Suppression Systems currently available in the mining industry.</li></ul>	quipment marks
	/ 6

#### Question 5 - Conveyor gantry structural integrity

You are the Mechanical Engineering Manager of a coal mine that has an elevated gantry conveyor extending from the side of a hill, and feeding coal into a Rill tower in the centre of a coal stockpile. The maintenance Shift Engineer notifies you that a land slip has occurred at the base of the 40 metre high T2 trestle leg partially exposing the foundations. The longwall is currently suffering extremely poor strata conditions around the maingate corner and production cannot be stopped.



conveyor gantry assembly? Describe five (5).	10 marks

		/ 1
В.	Identify three (3) external people you would consult to assist in the investigation. 3 mark	S
		1
C.	Identify four (4) potential contributing factors to the land slip beneath the conveyor? 4 m	arks

D.	What monitoring could be utilised to indicate if there was ongoing movement in shut down the conveyor?	Trestle 2 to 3 marks
		/
Ε.	What controls could you put in place to ensure the ongoing use of the gantry could the land slip being remediated. Identify five (5).	nveyor prior to 5 marks
		/

#### Question 6 – Stockpile dozer

Your Mine has received a significant amount of rain in the previous 48 hours, and a stockpile dozer has become bogged on the product stockpile in proximity to a reclaim draw point. Communication with the dozer operator via their backup handheld radio indicates:

- They do NOT feel they are at immediate risk of the dozer being drawn in
- They stopped the reclaim conveyor from the dozer onboard controls when they first had traction issues
- Whilst trying to get traction to reverse the dozer out they have tripped the tilt switch which has stopped the engine, dropped the machine isolator, and they would have to exit the cabin onto the side platform to reset the main isolator
- The dozer is tilted forward at about 30 degrees, the stockpile material feels very loose, and the
  dozer feels like it is sitting on its belly plates, so even with the blade down they could potentially
  slide forward
- The dozer has NOT got a recovery harness in the cabin (even though they ticked it off in their electronic prestart)
- Their crib tin and water bottle are in the dozer cab along with some educational reading material

Video footage in the control room shows the dozer less than 5 metres to the side of, and 15 metres below, the stockpile aerial conveyor gantry walkway side.

A.	Draw down points on stockpiles are considered hazardous to mobile plant, such as doz operating in proximity to them. Describe three (3) contributing factors to a dozer being in a draw down point.  6 ma	caught
		/ 6

B. If a dozer were to the risks of	harm / hazards t	o personnel. List five	(3)	01	marks
		d be installed on stoo stockpiles. List five (			/ to dozer
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υ.	Detail three (3) potential recovery strategies for the dozer operator and dozer that you complement.  6 mar	
		/ 6
E.	Select one of the above recovery methods you detailed and describe three (3) foresees hazards specific to the recovery process.  3 mar	

#### **Question 7 - Hot work**

On 18th January, 2024, SafeWork Australia amended the workplace exposure standard (WES) for welding fumes. Exposure standards should not be considered as representing an acceptable level of exposure. They establish a statutory maximum upper limit.

As Mechanical Engineering Manager at a Mine, to comply with the WHS legislation you must take all reasonably practicable steps to eliminate or minimise the risks from exposure to welding fumes, not just ensure that exposure is below the WES.

,	Identify four (4) actions SafeWork recommend you take to minimise workers exposure welding fumes.  4 ma	
		/ 4
В.	List three (3) principal hazard management plans or principal control plans that directly manage aspects of hot work  3 ma	/ 4
В.		/ 4
В.		14
В.		12
В.		12
В.		/ 4

<ul> <li>C. Technical Reference Guide (TRG 25) Hot Work (cutting and welding) at mines and pet sites, Section 2.3 common hazards of hot work, identifies factors involved singularly or cumulatively in hot work incidents. It includes a list of hazards associated with hot work eight (8) hazards associated with hot work.</li> </ul>	a. List
	/ 0
	/ 8

D.	The SafeWork limit for welding fumes states workers must not be exposed to levels of to welding fumes greater than 1 mg/m3 over an eight-hour working day, based on a five-da working week. List five controls you will implement to control the potential for toxic welding fumes exceeding the exposure limit.  5 mark	y ng
		/ 5
E.	TRG 25 Section 2.5 identifies other controls that may be applicable to all hot work activities List five (5).  5 mark	
		/ :

#### **Question 8 – Blasting and Painting SEP**

As part of your statutory mechanical role you are responsible for a relatively new coal processing plant and train loading facility. These are steel structures and some of the structural members and access systems are beginning to show signs of paint loss and surface corrosion. Your recent annual third party structural audit has identified that a blasting and painting program is required to be implemented. As your mine does not currently have a Standard of Engineering Practice (SEP) for Blasting and Painting you have been asked to develop one from scratch.

A.	Outline the logical process steps you would take to develop this new standard of engin practice. List eight (8) steps.  8 ma	
		/8
B.	List five (5) personnel or organisations you would involve in the risk assessment for bla and painting 5 ma	
		/ 5

and paintin	g				0111	arks
D. List six (6)	controls you wou	ld consider im	plementing to r	nitigate the ha		
D. List six (6)	controls you wou	ld consider im	plementing to r	nitigate the ha		ntified arks
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### **Question 9 – Transport Braking System (TBS)**

#### **Essential Elements**

You are the Mechanical Engineering Manager of an underground coal mine that runs a fleet of diesel mobile plant including personnel transports and LHD's. One of the safety critical functions that must be operational for safe use is brakes.

#### **Essential Elements**

A.	In relation to brakes on mobile plant used underground at coal mines in New Sout what must each item of plant have in place from a legislative perspective for it to be the requirement is considered essential, and must be included in your answincluded the candidate will be deemed not yet competent for the question.	oe opei	rated.
		2 mark	(S
			/2
В.	Under what legislation are these braking system documents issued.	2 mark	(S
			/2
C.	There are twelve (12) items of information you would expect to find on the braking certification document that relates specifically to the registration. List eight (8) of the second control of the registration of the registration of the registration.	-	

		/
D.	Periodically the braking systems are to be inspected and audited for compliance to the requirements of the braking system design approvals. List six (6) inspections you wo implement, and the typical time frequency of these inspections.	uld
	6 n	narks

Your longwall team have arranged for an item of diesel hire equipment to come to site on shor hire to assist in towing a 35 tonne longwall pump station underground. You arrange for a third independent inspection to be conducted as part of the introduction to site. During the audit the party has found there is no TBS name plate attached to the vehicle, and that the circuit has be hosed up incorrectly. The hosing appears to be a larger diameter than approved for the brakin system, and a larger volume hydraulic accumulator is fitted into the braking system than has be nominated in the approved Schematic.	party third en g
E. Describe three (3) potential issues that may arise from this situation? 6 ma	rks
	/ 6
F. Identify five (5) actions you would take to resolve the issue 5 ma	rks
	/ 5

### **Question 10 – Short Answer - Scaffolding**

A. Match the class of scaffolding license to the proposed scaffolding works by drawing arrows to the most correct answer 5 marks

Proposed scaffolding works	Arrow	Class of scaffolding license
Dismantling tube and coupler scaffolds		Competent person, or SA/SB/SI
·		' '
Erecting prefabricated scaffold under 4m		Basic scaffolder (SB)
Erecting modular or prefabricated scaffolds		Intermediate scaffolder (SI)
Dismantling suspended scaffold		None
Conducting 30 day inspection of a scaffold		Advanced scaffolder (SA)

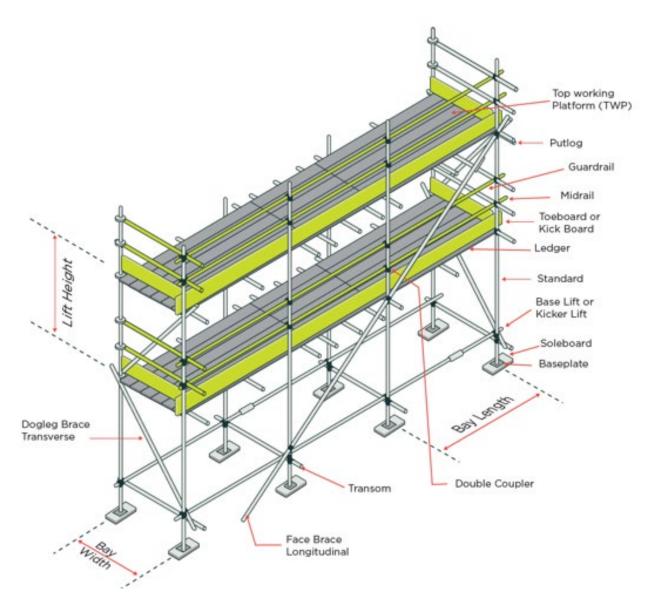
/ 5

B. List five (5) pieces of information a scaffold designer would require from the mine to bu	
scaffold for a task 5	marks
	1.5
	/ 5

- C. Which types of scaffold are required to be designed by an engineer? Circle all that apply. A wrong answer equates to no marks for this question 3 marks
  - a) A scaffold that is above 30m to the top working platform height
  - b) a scaffold with a cantilevered platform
  - c) a scaffold that uses beam or truss elements
  - d) a hung scaffold
  - e) a scaffold that included containment (i.e. brattice or screen/mesh)

/ 3

Consider the drawing below and answer the following questions.



D. What are the following dimensions in millimetres	
---	--

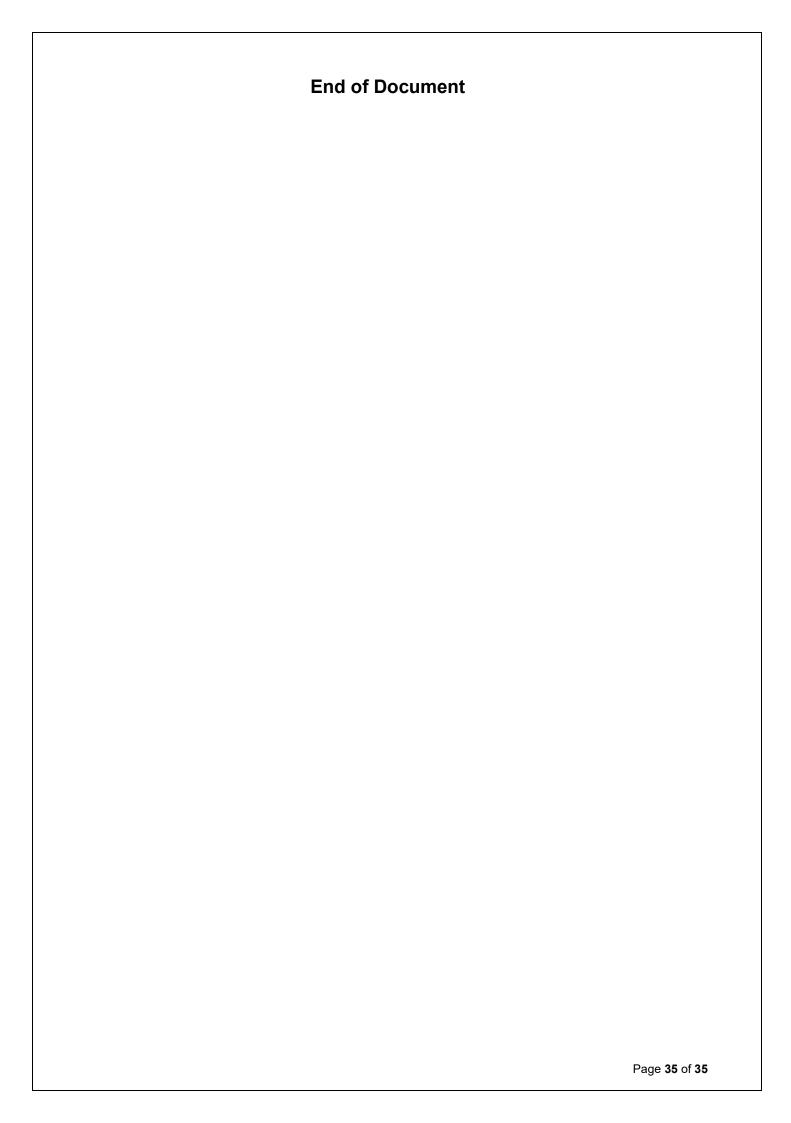
What is the maximum permitted lift height?

Question

5 marks

Answer (mm)

What is the maximum distance a putlog can be from a standard?		
What is the minimum bay width for a light duty scaffold?		
What is the maximum allowable gap between planks forming a working platform	m?	
How far past the landing must the ladder extend?		
'		/ 5
		75
E. What are the following requirements?		
a. What is the minimum and maximum slope for a scaffold access	ss ladder? 2 marks	<b>3</b>
b. What is the maximum height between successive ladder land	ings? 2 marks	
b. What is the maximum height between successive ladder land	ings? 2 marks	
b. What is the maximum height between successive ladder land	ings? 2 marks	
b. What is the maximum height between successive ladder land	ings? 2 marks	3
b. What is the maximum height between successive ladder land	ings? 2 marks	
		3
	or edge protection?	3
	or edge protection?	3
b. What is the maximum height between successive ladder land	or edge protection?	3
	or edge protection?	3





#### CME2 – Legislation and standards applicable to underground coal mines

CANDIDATE NUMBER:	(write in from your letter)

## MECHANICAL ENGINEERING MANAGER OF UNDERGROUND COAL MINES EXAMINATION FOR CERTIFICATE OF COMPETENCE

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**Date:** 31 July 2024 **Start time:** 13:00:00 **Finish time:** 15:10:00

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6	Α					Page <b>2</b> of <b>33</b>

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PAPER	Verdict		TOTAL	/ 250		Marks checked by:

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#### CME2 – Legislation and standards applicable to underground coal mines

## **Question 1 – Role of Mechanical Engineer and MECP**

**Essential** 

The candidate must be assessed as competent for this question, both Part A and Part B, in order to be considered as being competent for the entire exam.

Part A - The role of the Mechanical Engineering Manager

A. Fill in the blanks in the extract of legislation below regarding the role of the Mechanical
 Engineering Manager.

Work Health and Safety (Mines and Petroleum Sites) Regulation Schedule 10 Part 2 Underground coal mines

- 5 Mechanical engineering manager
- 1) The statutory functions of a Mechanical Engineering Manager are:

a.	To		
		, and	the mechanical
		ocedures forming part of the mini	
b.	to supervise the	•	
		and	of mechanica
	plant at the mine.		
2) Th	e requirement for nomination to	exercise the statutory functions	is that the individual nominated
mu	st		
— tha	t authorises the exercise of the	statutory functions.	

/ 9

#### Part B - Mechanical Engineering Control Plan

Work Health and Safety (Mines and Petroleum Sites) Regulation

## 30 Principal control plans

- (1) The operator of a mine or petroleum site must comply with the requirements for principal control plans specified in this section and Schedule 2.
- (2) A principal control plan must—
  - (a) be documented, and
  - (b) as far as reasonably practicable, be set out and expressed in a way that is readily understandable by persons who use it.
- (3) The operator of a mine or petroleum site must prepare a health control plan for the mine or petroleum site that sets out the means by which the operator will manage the risks to health associated with mining operations or petroleum operations at the mine or petroleum site in accordance with section 14.
- (4) The operator of a mine or petroleum site at which there is a risk to health and safety associated with the mechanical aspects of plant and structures at the mine or petroleum site must—

В.	With regard to section 30 (4) what must the operator ensure?	marks
-		
		/ 8

Work Health and Safety (Mines and Petroleum Sites) Regulation	
Schedule 2 Principal control plans	
2 Mechanical engineering control plan	
(4) The following matters must be taken into account when developing a control measure referr	ed to
in subsection (2) for a belt conveyor—	
C. WHS(MPS)R Schedule 2 (2) (4) refers to matters that must be taken into account when developing control measures for belt conveyors. Identify all five (5).	S
	/ 8

	Question 2 -	- Managing	risks to	health	and safety
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Work Health and Safety (Mines and Petroleum Sites) Regulation

- 14 Management of risks to health and safety
- (1) A person conducting a business or undertaking at a mine or petroleum site must manage risks to health and safety associated with mining operations or petroleum operations at the mine or petroleum site in accordance with the WHS Regulations, Part 3.1.
- (2) A person conducting a business or undertaking at a mine or petroleum site must ensure ....

A. What must the PCBU ensure?  3 marks  B. According to 14 (3) in conducting a risk assessment the person must have regard to what?  3 marks	S
3. According to 14 (3) in conducting a risk assessment the person must have regard to what?	
3. According to 14 (3) in conducting a risk assessment the person must have regard to what?	
	/ 3
	7.5
3 mark:	
	S
	/ 3
C. According to 14 (5) requires records to be kept of what? 3 marks	s
	/ 3

D. What records are not required to be kept under 14 (6)?	2 marks
	/ 2
E. As part of the mines expansion project you will be introducing new mobile plathat has not been used at the mine before. List seven (7) different roles that you the risk assessment, and why you would include each of them.	
	/ 14

## Question 3 - WHS Act - Primary duty of care

Work Health and Safety Act

#### 19 Primary duty of care

- (1) A person conducting a business or undertaking must ensure, so far as is reasonably practicable, the health and safety of--
  - (a) workers engaged, or caused to be engaged by the person, and
  - (b) workers whose activities in carrying out work are influenced or directed by the person,
- (2) while the workers are at work in the business or undertaking.
- (3) A person conducting a business or undertaking must ensure, so far as is reasonably practicable, that the health and safety of other persons is not put at risk from work carried out as part of the conduct of the business or undertaking.
- (4) Without limiting subsections (1) and (2), a person conducting a business or undertaking must ensure, so far as is reasonably practicable--

A.	With respect to Section 19 (3) the mine operator as PCBU, as well as any other PCBUs at have a primary duty of care to ensure, so far as is reasonably practicable, that workers and people are not exposed to health and safety risks arising from the business or undertaking	l other This
	duty in relation to the mechanical aspects of plant and structures includes ensuring what, s is reasonably practicable?  13 ma	
_		
_		
-		
		/ 13

specifica	nate systems or St				lifecycle of plant 6 marks	
						,
The safe	ety management s	ystem requires a	hierarchal struct	ure of documents	to effectively	1
manage	use to manage W	. List six (6) tiers	of mechanical do	ocuments from hig	hest to lowest that	
manage you will	hazards at mines use to manage W	. List six (6) tiers	of mechanical do	ocuments from hig	hest to lowest that cal plant and	
manage you will	hazards at mines use to manage W	. List six (6) tiers	of mechanical do	ocuments from hig	hest to lowest that cal plant and	
manage you will	hazards at mines use to manage W	. List six (6) tiers	of mechanical do	ocuments from hig	hest to lowest that cal plant and	<i>1</i>
manage you will	hazards at mines use to manage W	. List six (6) tiers	of mechanical do	ocuments from hig	hest to lowest that cal plant and	
manage you will	hazards at mines use to manage W	. List six (6) tiers	of mechanical do	ocuments from hig	hest to lowest that cal plant and	
manage you will	hazards at mines use to manage W	. List six (6) tiers	of mechanical do	ocuments from hig	hest to lowest that cal plant and	
manage you will	hazards at mines use to manage W	. List six (6) tiers	of mechanical do	ocuments from hig	hest to lowest that cal plant and	

You have accepted the position as the Mechanical Engineering Manager at a well established mine, and have been requested by the Mine Operator to review the confined spaces at the mine, as well as the conditions for working in them.

A.	As detailed in Work Health and Safety Regulation Clause 5 Definitions what are the refor a confined space.	equiremen 7 marks	ts
			/7
B.	What is specifically <b>NOT</b> included as a confined space?	2 marks	
			/ 2

Clause 64 outlines the duty of designers, manufacturers, importers, suppliers, installers and constructors of plant or structures with regards to eliminating or minimising the risk relating confined spaces. What must they ensure?  6 mail	to
	1
What technical references specifically addressing the management of confined spaces wor refer to in your review. Identify two (2).	
	1

<ul> <li>E. With respect to entry into confined spaces for each of the items below detail both the the acronym and your understanding of the term.</li> <li>(a) LEL</li> <li>(b) UEL</li> <li>(c) TWA</li> <li>(d) STEL</li> </ul>	e meaning of 8 marks
	1.0
	/ 8

## Question 5 – Lifting and cranage SEP

You are investigating an incident at your mine that resulted in the rollover of a telehandler whilst lifting a reel of high voltage cable on ground that was not quite level. You have determined the operator had not lowered the outriggers as they planned to immediately tram the telehandler with the cable to load it on an A-frame skid. The jib crane attachment for the 12 tonne telehandler was only rated for a 2 tonne lift, so the operator had slung the load under the forks using chain slings. On the uneven ground the load had swung to one side and the telehandler slowly overturned. The operator was not injured, although the telehandler boom is bent.

You have decided to review your lifting and cranage standard of engineering practice (SEP). You have reviewed the Resources Regulator website for applicable Safety Alerts and Bulletins, including two in the last 12 months that directly relate to lifting and cranage. These are Safety Bulletin SB23-08 Haul truck front strut removal poses risks to workers, dated October 2023, and Safety Alert SA23-07 Haul truck engine module narrowly misses workers, dated December 2023. Refer below:

Resources Regulator Department of Regional NSW



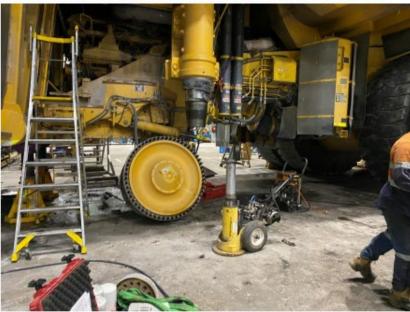
## Safety Bulletin

Date: October 2023

### Haul truck front strut removal poses risks to workers

This safety bulletin provides safety advice for the NSW mining industry.





#### Issue

There have been 4 significant incidents with the high potential to cause serious injury or death in relation to removing and/or dismantling in situ haul truck front suspension struts over the past 20 months. Three of these incidents have occurred in the past 6 months.

All of these incidents were captured on workshop video footage. All of the incidents showed workers in close proximity to heavy components, and actual contact with workers during one incident, although none resulted in serious injury.

The most recent incident on 18 September 2023, had the potential for much worse outcomes, and has prompted the Resources Regulator to highlight this known hazard.

#### Resources Regulator Department of Regional NSW



## Safety Alert

Date: December 2023

## Haul truck engine module narrowly misses workers

This safety alert provides safety advice for the NSW mining industry.

#### Issue

Two workers were in the engine bay of a Komatsu 930E haul truck adjusting lever hoists (cumalongs) and lifting chains while installing an engine module on 15 November 2023. As the overhead gantry crane operator was taking the weight of the module on the crane, the module slid back on the supporting tracks about 1.5 m. Both workers took evasive action to avoid being hit or crushed by the moving module, but were uninjured.

This dangerous incident was neither immediately reported, nor the incident scene preserved.

Figure 1: Worker manoeuvring engine module







#### Circumstances

Eight workers, from Komatsu and Cummins, were assigned to overhaul a Komatsu 930E rear dump truck in the mine workshop. Four of those workers were involved in changing the engine module which consisted of the main alternator, engine and radiator.

A.	Who would you involve in the review of the Lifting and Cranage SEP? List eight (8). 8 ma	arks
		T
		/ 8

. What major s and explain v	what outcomes you	u would expect from ea	ion stop.	O me	rks
		on your mine site what e. Identify and describe		-	
		on your mine site what e. Identify and describe		ould you ensure a 8 ma	are in
				-	are in
				-	are in
				-	are in
				-	are in
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				-	are in
				-	are in
				-	are in
				-	are in

## Question 6 - Airborne contaminants

Work Health and Safety Regulation 2017
Division 7 Managing risks from airborne contaminants

#### 49 Ensuring exposure standards for substances and mixtures not exceeded

A person conducting a business or undertaking at a workplace must ensure that no person at the workplace is exposed to a substance or mixture in an airborne concentration that exceeds the exposure standard for the substance or mixture.

#### 50 Monitoring airborne contaminant levels

- (1) A person conducting a business or undertaking at a workplace must ensure that air monitoring is carried out to determine the airborne concentration of a substance or mixture at the workplace to which an exposure standard applies if
  - a) the person is not certain on reasonable grounds whether or not the airborne concentration of the substance or mixture at the workplace exceeds the relevant exposure standard, or
  - b) monitoring is necessary to determine whether there is a risk to health.
- (2) A person conducting a business or undertaking at a workplace must ensure that the results of air monitoring carried out under subclause (1) are recorded, and kept for 30 years after the date the record is made.
- (3) A person conducting a business or undertaking at a workplace must ensure that the results of air monitoring carried out under subclause (1) are readily accessible to persons at the workplace who may be exposed to the substance or mixture.

#### Part A - General

A.	Provide do	escriptions for the following key terms associated with exposure standards.  Airborne contaminant	4 marks
	ii.	Breathing zone	
			/ 4

Part B – Welding fumes	
<ul> <li>B. The Welding Fume Exposure Standard in Australia was lowered in September 2023 by SafeWork Australia. What is the current welding fume exposure standard limit?</li> <li>1 marks</li> </ul>	
	1
You are the mechanical engineer at a coal mine and have a number of welding tradespeople working in maintenance at your operation. Welding and fabrication work occurs in your maintenance workshop along with other maintenance and servicing work.	
C. With the advent of the new reduced welding fume exposure standards, what controls will you put in place to protect your workforce? List five (5).  5 marks	
	5

Part C – Airborne dust
The NSW Health and Safety legislation defines airborne dust to include both respirable dust and inhalable dust. Long-term exposure to many dusts, including respirable coal dust and respirable crystalline silica, can cause disabling lung diseases.
<ul> <li>D. Describe the properties of the following types of dust found in coal mining, and what their workplace exposure standard limits are.</li> <li>i. Inhalable dust</li> <li>ii. Respirable dust</li> <li>iii. Crystalline silica respirable dust</li> </ul>
<ul> <li>E. Name two (2) respiratory lung diseases caused from inhalation of respirable dust in mining and explain why these diseases are so damaging and may not be easily reversible.</li> <li>2 marks</li> </ul>
/2
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F.	What systems and controls can you implement to ensure that your "field servicing" crew re safe from dust diseases whilst they carry out their servicing, especially on ground engaging equipment such as drill rigs and excavators? Identify seven (7) appropriate systems and / controls.  7 ma	g or
_		
_		
_		
		/7

## **Question 7 – Falling objects**

Work Health and Safety Regulation 2017 Division 10 Falling objects

### 54 Management of risk of falling objects

A person conducting a business or undertaking at a workplace must manage, in accordance with Part 3.1, risks to health and safety associated with an object falling on a person if the falling object is reasonably likely to injure the person.

Note—WHS Act—section 19 (see clause 9).

#### 55 Minimising risk associated with falling objects

- (1) This clause applies if it is not reasonably practicable to eliminate the risk referred to in clause 54.
- (2) The person conducting the business or undertaking at a workplace must minimise the risk of an object falling on a person by providing adequate protection against the risk in accordance with this clause.
- (3) The person provides adequate protection against the risk if the person provides and maintains a safe system of work, including—

Α.	With reference to WHS Regulation Clause 55 (3) (a) and (b) what must be included in the system of work?  4 mar	
		/ 4
3.	WHS Regulation Clause 36 Hierarchy of controls identifies the duty holders requirements if can not be eliminated. What are these preventative requirements?  4 mar	
		/ 4

C.	Identify eight (8) items of infrastructure (plant or structure) on a mine site where it is reason consider there is a risk of falling objects potentially injuring personnel.	
		/ 8
D.	For each of three (3) items of infrastructure you have identified above describe three (3) co you would implement to minimise the risk of falling objects. You <b>CAN NOT</b> use the same or more than once.  9 mai	ontrol
		/ 9

Question 8 – Winders	
A. According to Work Health and Safety (Mines and Petroleum Sites) Regu Dictionary what is the definition of a winding system?	ılation Schedule 15 3 marks
	/3
	/3
<ul> <li>Work Health and Safety (Mines and Petroleum Sites) Regulation</li> <li>Winding systems <ol> <li>The mine operator of an underground mine must ensure every winding may be put into use at the mine includes the following—</li> <li>ropes and devices that can withstand all forces reasonably experopes and devices,</li> <li>control measures to prevent, as far as reasonably practicable, a</li> </ol> </li> </ul>	ected to be borne by the
3. For Section 50 (b) list all four (4) conditions with respect to the shaft conveyance that must be prevented.  4 marks	
	/ 4
C. According to Section 50 (c) how many braking systems are required for a why?	any winding system and 2 marks
	/2

<ul> <li>D. Section 50 (f) requires control measures that detect 1 or more of what four (4) types of malfunctions. List all four (4).</li> </ul>	
manufictions. List all four (4).	4 marks
	/ 4
E. According to Section 50 (k) in the case of multi rope winders what must be provided	ded? 1 marks
	/1

### WHS(MPS) Regulations Schedule 1 Part 1

#### 3 Mine shafts and winding systems

The following matters must be considered in developing the control measures to manage the risks associated with mine shafts and winding systems—

- (a) the potential for instability and loss of integrity of the shaft,
- (b) the potential for fires in underground operations, the shaft or winder areas,
- (c) the potential for an unintended or uncontrolled movement of conveyances within the shaft,
- (d) the potential for a conveyance to fall down the shaft,
- (e) the potential for failure of, or damage to, equipment and control measures, including the following—
  - control measures that are intended to prevent a shaft conveyance from overwind, excessive acceleration or deceleration, unsafe or excessive speeds or uncontrolled movement,
  - ii. control measures that are intended to detect the presence of slack rope, drum slip conditions or unsafe tail rope conditions,
  - iii. braking systems and systems performing an equivalent function that are intended to ensure the winder remains under control,
  - iv. warning systems that are intended to alert persons at the mine to an emergency in a winding system,
  - v. communication systems,
- (f) the potential for injury to a person from— ...
- (g) provision for the emergency exit of persons from a conveyance.

F. 6) With respect to section 3 (d) what effective control measures would you maintain to prevent the potential for a conveyance to fall down the shaft. De controls.	= -
	/ 5
G. With respect to mine shafts and winding systems 3 (f) identifies four (4) not	ential econorios where
G. With respect to mine shafts and winding systems 3 (f) identifies four (4) pote injury to person(s) may result. Identify three (3) of these scenarios.	ential scenarios where 3 marks
· · · · · · · · · · · · · · · · · · ·	
* * * * * * * * * * * * * * * * * * * *	3 marks / 3
H. With respect to mine shafts and winding systems Clause 3 (g) requires provemergency exit of persons from a conveyance. Describe three (3) methods	3 marks  / 3  // 3  // sion for the // you would consider for
H. With respect to mine shafts and winding systems Clause 3 (g) requires provening emergency exit of persons from a conveyance. Describe three (3) methods	3 marks  / 3  // 3  // sion for the // you would consider for
H. With respect to mine shafts and winding systems Clause 3 (g) requires provenergency exit of persons from a conveyance. Describe three (3) methods	3 marks  // 3  // sision for the you would consider for

## **Question 9 – Entanglement**

Recent significant incidents resulting in permanently disabling injuries have highlighted the hazard of entanglement. One of the primary elements of the Mines Safety Management System to detail the preventative and mitigative strategies is the Mechanical Engineering Control Plan.

A. WHS Regulation 2017 Division 2 Duties of persons conducting business or undertakings that design plant, Clause 189 Guarding identifies specific requirements. Fill in the missing words.

11 marks

<b>189</b> 1) 2)		ned for
3)	that purpose will to the danger point or danger area of the designer must ensure that—  (a) if access to the area of the plant requiring guarding is not necessary during operations.	
	maintenance or cleaning of the plant—the guarding is aphysical barrier, or (b) if access to the area of the plant requiring guarding is necessary during operation	,
	maintenance or cleaning of the plant—the guarding is an physical barrier that allows access to the area being guarded at times when that a does not present a risk and prevents access to that area at any other time, or (c) if it is not reasonably practicable to use guarding referred to in paragraph (a) or (b) guarding used is a physical barrier that can only be altered or removed by the	
	(d) if it is not reasonably practicable to use guarding referred to in paragraph (a), (b)	or (c)—
4)	the design includes a safeg system that eliminates any risk arising from the area of the plant requiring guardin a person or any part of a person is in the area being guarded.  The designer must ensure that the guarding is designed—	uarding g while
	(a) to be of and and so as to resist impact or shock, and	
	(b) to make or of the g whether deliberately or by accident, as difficult as is reasonably practicable, and	uarding,
5)	(c) so as not to cause a in itself.  If the plant to be guarded contains moving parts and those parts may break or cause workpieces to be ejected from the plant, the designer must ensure, so far as is reason practicable, that the guarding will control any risk from those broken or ejected parts a workpieces.	
6)	·	
	unless the guarding is replaced.	
		/ 11

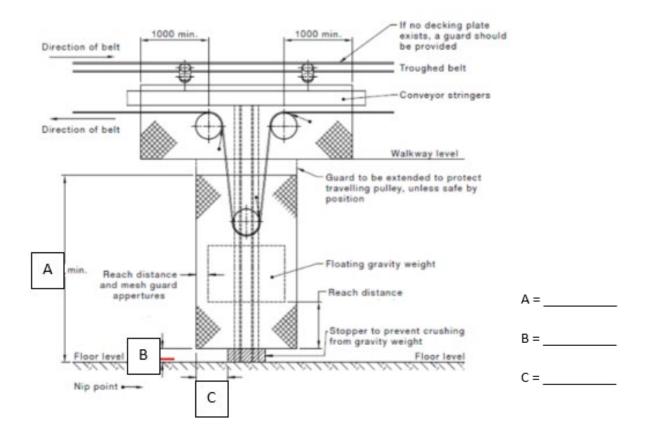
B. Identify four (4) key controls for the management of entanglement.	4 marks
	/ 4
Figure 1 - Reaching Upwards (Machinery)	
C. What is the minimum height (figure 1 – h above) to prevent access to a high risk h above an accessible area?	nazard zone arks
above an accessible area:	arno
	uno .
above all accessible area:	/ 1
The AS4024 series of Australian Standards cover safeguarding of machinery.  D. When considering conveyor boot ends what are dimensions A and B in the diagra	/ 1 m below?
The AS4024 series of Australian Standards cover safeguarding of machinery.	/1

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/2

E. When considering conveyor vertical loop take ups what are dimensions A, B and C in the diagram below?

3 marks



/ 3

- F. Polymer guards are increasingly used across the mining industry. In terms of hazards associated with poly guards describe two (2) hazards their use can reduce (Pros), and two (2) hazards their use can introduce (Cons).
  - i. Pros

ii. Cons

/ 4

## Question 10 - SB24-02 LHD crowd cylinders

You are the Mechanical Engineering Manager of a low height underground mine, and have a small fleet of CoalTram CT10LP LHD's. Your conveyor install crew were using a similar bolting rig basket in a high roof chamber to install roof bolts for rated lifting plates and conveyor hanging bolts for a new trunk conveyor drive and loop take up. Whilst the basket was lifted to full height by the LHD, and drilling a roof bolt hole, the basket attachment has rotated forward quickly, but not in free fall, resulting in the front of the basket contacting the floor. The movement was not initiated by the LHD operator, and although the worker in the basket fell forward, they were shaken but uninjured. You recollect receiving a weekly update e-mail from the Resources Regulator with a link to the Safety Bulletin below.





## Safety Bulletin

Date: April 2024

## LHD crowd cylinder failures - potential worker injuries

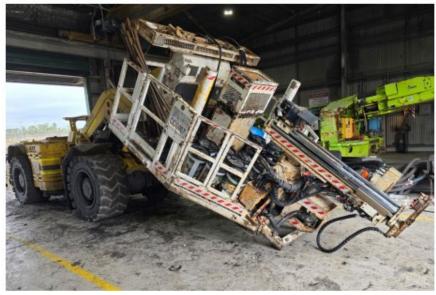
This safety bulletin provides safety advice for the NSW mining industry.

#### Issue

In the past 9 months, there have been 5 significant incidents involving the hydraulic crowd cylinders on load haul dump (LHD) machines in underground coal mines. Four of these incidents have occurred in the past 4 months.

The crowd cylinder forms the top mount supporting the attachment plate. LHDs in the underground coal industry are widely used as utility vehicles, coupling to a variety of implements including some where people are elevated (such as work baskets and drill rigs). Overloading or failure of the crowd cylinder can cause the implement to drop and rotate about the lower load arm pivot joint. Any people in the machine, or in close proximity on the ground, are placed at immediate risk of serious injury or worse.

Figure 1: LHD with drill rig attachment during simulation testing after crowd cylinder failure



Safety Bulletin SB24-02 includes two incidents where the QDS drill rig platform shown above, attached to a CT10LP, has rotated forward whilst workers were in the basket.	
A. Based on having similar mobile plant and attachments at your Mine what was your obligation under legislation when you received the safety bulletin?      1 marks	
	/ 1
B. Identify five (5) potential causes of the unintended activation at your mine. 5 mar	ks
	/ 5
C. Who would you involve in your incident investigation. List five (5) people or organisations.  5 mar	ks
	/ 5

υ.	What specific documents on site would you reference. Plant safety file is not specific er four (4).	ough. List marks
		/ 4
Ξ.	What testing would you initiate to determine the root cause? Identify four (4) tests. 4	marks
		/ 4
F.	Detail three (3) items of information would you require from the LHD OEM to assist in d the root cause of the incident.	etermining marks
		/ 3
G.	Detail three items of information would you require from the attachment OEM to assist i determining the root cause of the incident.	n marks
		/ 3

