



Trade &
Investment
Mine Safety

MINE MECHANICAL ENGINEER CERTIFICATE OF COMPETENCE |
AUGUST 2014

**Examination for Certificate of Competence as a Mine Mechanical
Engineer**



CME3 Safety and Mining Legislation Applicable to Open-cut Coal Mines

Examination Date: 21 August 2014
 Examination Times: 1.30pm to 3.30pm
 Examination Venue: Hunter TAFE, Kurri Kurri.

Instructions to candidates: It is expected that candidates will present their answers in an engineering manner making full use of diagrams, tables, and relevant circuits where applicable and showing full working in calculations. Credit marks will be given for such work in assessing marks for these questions. Neatness in diagrams is essential and will be considered in the allocation of marks. Provide answers in point form wherever appropriate.

Electronic aids may not be used. All questions are to be attempted. All questions are of equal value but parts of questions may vary in value. Place your identification number only, NOT your name, on your paper. 10 minutes reading time is allowed prior to the start of the examination. Candidates can highlight points of importance during the reading time, using highlighters, but not begin answering the questions.

Part A Open book - Part B Closed book

Question 1 Compulsory (60 marks)

Your mine has a surface conveyor network which delivers run-of-mine to a surface bin and stock pile area. A recent structural inspection has identified a number of serious issues with the gantry support legs of the stock pile conveyor.

Issues identified in the report include heavy corrosion at the base of the support legs, damage, cracking and spalling of the concrete plinths and physical damage to the support legs some 5 metres above natural ground level.

The structural report also identifies one of the gantry support legs has at some stage sustained heavy contact with the stock pile dozer causing the leg to show signs of structural failure.

Note: The stock pile conveyor is an integral part of the operation and cannot be removed from service for long periods of time

- List 5 recommendations you would forward onto the operator on how you intend on managing the situation in the short term. (15 marks)
- How would you undertake major repairs to the damaged structure without impacting on the stock pile conveyor's availability? (15 marks)
- What engineering controls could you implement so as to prevent large mobile plant such as the push out dozer from making contact with and potentially damaging the conveyor gantry legs? (15 marks)
- What process would you use to satisfy yourself the repairs/modification made are to Standards of engineering practice and the structure is, as far as reasonability practicable, safe and without risk? (15 marks)

Question 2 Compulsory (60 marks)

The Manager of Mining Engineer of an underground operation has identified your aging Ex DES fleet requires recoding over the next few months.

Your fleet consists of a number of Load Haul Dump (LHD) from different Original Equipment Manufacturers (OEM) and a number of rubber tyred diesel vehicles (RTV) also from different OEM's.

To add complexity to your situation the OEM for two of your RTVs have ceased operation and are no longer in business.

- List the steps you would take in selecting a provider who is capable of undertaking the works regardless of the make or model of the equipment. (10 marks)
- As the coal operation is the owner of the plant, list the information you would provide to the repairer so they can undertake the code D overhauls. (10 marks)

- c) As the coal operation is the owner of the plant, how are you going to ensure the information provided to the repairer is the most current? (10 marks)
- d) During the preliminary inspection of the LHD the repairer identifies a number of non-conformances/failures to the ExDES design register documentation.
List 5 non-conformances/failures which would lead to a failure of the Ex DES system. (10 marks)
- e) Having identified non-conformances/failures, what is the responsibility of the repairer and what is the responsibility of the mine operator/plant owner? (10 marks)
- f) List the documentation you are going to require from the repairer to validate functionally and certification of the Ex DES system. (10 marks)

Question 3 Compulsory (60 marks)

Friction Winders

- a) Describe two methods of determining head rope tensions in a multi rope friction winder. Briefly describe each method together with their advantages and disadvantages. (5 marks)
- b) On a multi rope friction winder (4 ropes) what type of head rope construction would you expect to find and why? (5 marks)
- c) Why is a rope displacement or collar to collar check on the head ropes of a multi rope friction winder so important? (5 marks)
- d) What are the two main types of devices used to attach the head ropes of a friction winder to the conveyance and/or the counter weight? (5 marks)
- e) Why are balance ropes used on a multi rope friction winders? (5 marks)
- f) On a multi rope friction winder what type of rope construction would you expect a guide rope to be and why? (5 marks)
- g) What would the factor of safety (FOS) be for a newly installed guide rope in a vertical shaft? (5 marks)
- h) What would be the discard criteria for a guide rope in a vertical shaft? (5 marks)
- i) Describe two methods for the anchoring and tensioning of a guide rope in a vertical shaft application. (5 marks)
- j) Describe two important points you need to consider when tensioning a guide rope in a vertical shaft application and why. (5 marks)
- k) List what areas within the shaft or winding tower would be of most concern that may led to a reduction in life expectancy of the rope and why. (5 marks)
- l) List the maintenance strategies you would adopt in an attempt to maximum the life of a vertical shaft guide rope. (5 marks)

Question 4 Compulsory (60 marks)

Describe each of the following and provide an example of each.

- a) JSA
- b) WRAC
- c) FMECA
- d) HAZOP
- e) Fault/logic tree analysis
- f) Bow tie analysis
- g) Human error analysis
- h) Event/decision Tree analysis
- i) QRA
- j) CAT level
- k) Base line monitoring
- l) DPM
- m) ICAM
- n) SDS
- o) TOPS
- p) ISO
- q) Conveyor
- r) Fail safe
- s) Fixed guarding

- t) Explosion protected

Question 5 Elective (60 marks)

During an annual non-destructive testing (NDT) inspection of the Men & Materials shaft it has been identified that a 30m section of fixed guide requires replacing.

This is due to a combination of the wall brackets separating from the fixed guide/shaft wall and the wall thickness of the guide being below acceptable limits.

- List the hazards associated with completing work in this location. (20 marks)
- List the risk controls you would implement for the hazards identified in part a). (20 marks)
- Outline a plan, with required documentation, to complete this work. (20 marks)

Note: Diagrams may be used to assist in your answer

Question 6 Elective (60 marks)

A structural cross member is required to be replaced on the top of the run-of-mine coal bin. The replacement will require hot work to be performed.

- List the hazards associated with completing hot work in this location. (30 marks)
- List the risk controls you would implement for the hazards identified in a). (30 marks)

Question 7 Elective (60 marks)

Condition monitoring

The Manager of the mine where you are Manager of Mechanical Engineering has recently been exposed to the benefits of “condition monitoring” as applied to machine condition and predictive maintenance.

“Condition Monitoring” can be identified as the process of systematic collection of data for the purpose of evaluating system performance, reliability and maintenance needs, and for the purpose of planning maintenance activities.

- List 5 types of condition monitoring which can be effectively used on the plant and equipment operation at your mine. (20 marks)
- Give 2 examples of each of the 5 types of condition monitoring listed in part a), for use at your mine. (20 marks)
- Discuss the advantages and the limitations of the 5 types listed in a) for condition monitoring. (20 marks)

Question 8 Elective (60 marks)

The operator of your mine has identified the need to install a borehole pump to aid in the dewatering of the current longwall goafs.

The mine has enlisted the services of a surface drilling company to install a steel cased borehole some 500mm in diameter and some 280m deep in a remote area from the mine.

The works will involve the use of:

- Mobile surface drill rig
- Mobile diesels compressors
- Mobile diesel welders
- Diesel centrifugal water pumps
- Vehicle Loading Crane (VLC) for the movement of pipe casings and general lifting of plant

- List the major hazards associated with each piece of plant listed above. (15 marks)
- List the risk controls you would implement for the hazards identified in part a). (15 marks)
- What qualifications would you require for the personnel undertaking the works? (15 marks)
- What management systems would you use to control the works and how would it be supervised? (15 marks)

More information

Business Processes & Authorisations

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Acknowledgments

Mine Mechanical Engineer Examination Panel

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