



MINE MECHANICAL ENGINEER CERTIFICATE OF COMPETENCE | AUGUST 2014

Examination for Certificate of Competence as a Mine Mechanical Engineer

CME1 Mechanical engineering applicable to underground coal mines

Examination Date: 21 August 2014
Examination Times: 9.30am to 12.30pm
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 5 only questions are to be attempted of which Questions 1 to 4 are compulsory with the remaining question to be selected from questions 5 to 8. 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.

Closed book exam

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 RTV's have ceased operation and are no longer in business.

- a) 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)
- b) 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 2 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 2 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 2 methods for the anchoring and tensioning of a guide rope in a vertical shaft application. (5 marks)
- j) Describe 2 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.

- a) List the hazards associated with completing work in this location. (20 marks)
- b) List the risk controls you would implement for the hazards identified in part a). (20 marks)
- c) 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.

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

Question 7 Elective (60 marks)

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.

- a) List 5 types of condition monitoring which can be effectively used on the plant and equipment operation at your mine. (20 marks)
- b) Give 2 examples of each of the 5 types of condition monitoring listed in part a), for use at your mine. (20 marks)
- c) 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
- a) List the major hazards associated with each piece of plant listed above. (15 marks)
 - b) List the risk controls you would implement for the hazards identified in part a).(15 marks)
 - c) What qualifications would you require for the personnel undertaking the works? (15 marks)
 - d) What management systems would you use to control the works and how would it be supervised? (15 marks)

CME2 Legislation and Standards applicable to underground coal mines

Examination Date: 21 August 2014
 Examination Times: 1.30pm to 2.30pm
 Examination Venue: Hunter TAFE, Kurri Kurri.

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Open book exam

Question 1 (20 marks)

Work Health and Safety Regulation 2011, Clause 36 “Hierarchy of control measures”.

- a) Who is a duty holder? (5 marks)
- b) What is the role of the duty holder in Clause 36? (5 marks)
- c) How would you as the Manager of Mechanical Engineering for your operation ensure the requirements of Clause 36 “Hierarchy of control measures” are being applied? (5 marks)
- d) Clause 36 (3) (a) states the duty holder must minimise risks by substituting the hazard giving rise to the risk with something that gives rise to a lesser risk. Provide 2 examples of this. (5 marks)

Question 2 (20 marks)

Work Health and Safety Regulation 2011, Clause 214 “Powered mobile plant—general control of risk”.

- a) What are 5 general risks the PCBU is required manage? (10 marks)
- b) For each of the 5 general risks identified in question 2 a) give 2 examples of risk control measures. (10 marks)

Question 3 (20 marks)

Coal Mine Health & Safety Regulation 2006, Clause 20 “Mechanical Engineering Management Plan” (MEMP).

- a) List the provisions needed as part of your standards of engineering practice (SEP) for your coal operation. (5 marks)
- b) What safe guards would you put in place to ensure structures are safe? (5 marks)
- c) Clause 20 (e) states the MEMP must make provision for the safe use and storage of pressurised fluids. How would you ensure the safe use and storage of pressurised fluids? (5 marks)

- d) Clause 20 (f) requires a means for the prevention, detection and suppression of fires on mobile plant and conveyors.

As the Manager of Mechanical Engineering for the coal operation how would you meet this obligation? (5 marks)

Question 4 (20 marks)

Coal Mine Health & Safety Regulation 2006, Clause 66 “Aluminium or light metal alloys”.

- a) Why is aluminium or light metal alloy a hazard in an underground coal operation? (5 marks)
- b) What risk control measures would you expect to see when allowing aluminium or light metal alloy underground at a coal operation? (5 marks)
- c) How would you control the use of aluminium or light metal alloy at your underground coal operation? (5 marks)
- d) How, as far as reasonably practicable, could you use a tool containing aluminium or light alloy in the underground parts of a coal operation? (5 marks)

Question 5 Gazettal - legislative update (20 marks)

Gazettal No 24 dated 2 February 2007 “Requirements for design registration of powered winding systems” (Gazettal attached)

- a) Who is able to undertake certification of your powered winding system and how would you verify the person undertaking the certification is qualified to do so? (5 marks)
- b) List the information, best describing your powered winding system, you would provide the qualified person to confirm the current status.
How would you confirm the information provided is correct? (5 marks)
- c) What elements of a design and operational risk assessment would you need to consider? (5 marks)
- d) Part of the 5 yearly design review requires the winder to be re-commissioned. List the requirements and the process you would implement. (5 marks)

END OF QUESTIONS

END OF PAPER

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

Examination Date: 21 August 2014
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Examination Venue: Hunter TAFE, Kurri Kurri.

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Part A Open book - Part B Closed book

Part A – Open book

Question 1 (25 marks)

Work Health and Safety Regulation 2011, Clause 36 “Hierarchy of control measures”.

- Who is a duty holder? (5 marks)
- What is the role of the duty holder in Clause 36? (5 marks)
- How would you, as the Qualified Mechanical Engineer for your operation, ensure the requirements of Clause 36 “Hierarchy of control measures” are being applied? (5 marks)
- Clause 36 (3) (a) states the duty holder must minimise risks by substituting the hazard giving rise to the risk with something that gives rise to a lesser risk. Provide 2 examples of this. (5 marks)
- Clause 38 (2) of the Work Health and Safety Regulations 2011 lists five circumstances, part (a) to (e), when a duty holder must review control measures. For each of the five circumstances, give an actual example that might prompt you to review control measures. (5 marks)

Question 2 (25 marks)

Work Health and Safety Regulation 2011, Clause 214 “Powered mobile plant—general control of risk”.

- What are 5 general risks the PCBU is required to manage? (5 marks)
- For each of the 5 general risks identified in part a) give 2 examples of risk control measures. (5 marks)
- For each risk control measure given in part b), describe how you would ensure that the control measures are maintained so that they remain effective according to the requirements of Clause 37 of the Regulations. (15 marks)

Question 3 (25 marks)

Coal Mine Health & Safety Regulation 2006, Clause 20 “Mechanical Engineering Management Plan” (MEMP).

- List the provisions needed as part of your standards of engineering practice (SEP) for your coal operation. (5 marks)
- What safe guards would you put in place to ensure structures are safe. (5 marks)
- Clause 20 (e) states the MEMP must make provision for the safe use and storage of pressurised fluids. How would you ensure the safe use and storage of pressurised fluids? (5 marks)
- Clause 20 (f) requires a means for the prevention, detection and suppression of fires on mobile plant and conveyors.

- e) As the Qualified Mechanical Engineer for the coal operation how would you meet this obligation? (5 marks)
- f) Clause 13 (a) of the Coal Mine Health and Safety Regulation 2006 requires an inspection program for a coal operation.
- g) Briefly outline the inspection program you would develop and implement for the site workshop to ensure that it complies with these requirements.

Part B – Closed book

Question 4 (25 marks)

As the Qualified Mechanical Engineer you have been called during the night and informed of an incident involving a crane collapsing due to ground failure on a feed conveyor with coal scanning equipment attached at the CHPP.

The incident happened while a contract belt crew were lifting a new roll of belt into position to replace a split belt.

Note: All planning and arrangements for the work was carried out on afternoon shift. The work commenced on Night Shift due to the urgent need for the CHPP to re-commence production.

- a) List the steps you would take from initial phone call at 2.30am. (5 marks)
- b) List information you will be looking for on arrival on site. (5 marks)
- c) List the major hazards with this type of work. (5 marks)
- d) What steps would you need to take to recover the crane and return the conveyor to production? (5 marks)
- e) What system would you implement to prevent a re-occurrence of crane failures at the coal operation? (5 marks)

Question 5 (25 marks)

MDG15 – Section 3.7 Fire Control Systems.

- a) List the important points that must be considered when designing a fire suppression system. (5 marks)
- b) In regards to fixed fire suppression systems:
 - i. List and describe the types of activation available on mobile plant. (3 marks)
 - ii. How would you determine the method of activation? (2 marks)
- c) What is the purpose and benefit of a shutdown delay in an automatic fire suppression system? (5 marks)
- d) List five common causes of fire on a rear dump truck used in an open cut mine (5 marks)
- e) Briefly outline the training you would recommend for an operator of mobile plant that has a fire suppression system fitted. (5 marks)

Question 6 (25 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.

- a) List 5 recommendations you would forward on to the operator on how you intend to manage the situation in the short term. (5 marks)
- b) How would you undertake major repairs to the damaged structure without impacting on the stock pile conveyor's availability? (5 marks)

- c) 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? (5 marks)
- d) What process would you use to satisfy yourself that the repairs/modifications made are to Standards of Engineering practice and the structure is, as far as reasonability practicable, safe and without risk? (10 marks)

Question 7 (25 marks)

Describe and provide an example of each of the following.

- a) JSA
- b) HAZOP
- c) ICAM
- d) MDG 41
- e) MDG 15
- f) ROPS/FOPS
- g) NDT
- h) WLL
- i) TKPH
- j) Pyrolysis

Question 8 (25 marks)

Your mine has a workshop for the large mobile equipment that has suffered damage to the roofing sheets in a recent storm. Reproduce the JSA you would expect to see for the replacement of the roofing sheets. The workers will need to access the roof both internally and externally to complete the task.

- a) Present your answer in three columns; (1) task step, (2) hazard and (3) control measure. You are not required to risk rank the hazards for the purposes of this question. (10 marks)
- b) List the competencies and/or licences you would require the workers to have for the described task. (10 marks)
- c) List any assumptions you make. (5 marks)

More information

Business Processes & Authorisations

Phone: 4931 6625

Acknowledgments

Mine Mechanical Engineer Examination Panel

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