

EXAMINATION PAPER | CERTIFICATE OF COMPETENCE

# Electrical engineer of coal mines other than underground mines

July 2017

## CEE3 – Legislation and standards applicable to surface coal mines

### Instructions to candidates

Unless otherwise stated all references to Act and Regulations are to the

*Work Health and Safety Act 2011*

Work Health and Safety Regulation 2011

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

Work Health and Safety (Mines and Petroleum Sites) Regulation 2014

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 workings in calculations. Credit marks will be given for such work in assessing marks for these questions. If you are unable to fit your answer in the allocated space provided please utilise the blank page opposite the question.

Neatness in diagrams is essential and will be considered in the allocation of marks. Provide answers in point form wherever appropriate. State any assumptions you make in order to answer the question.

Questions are to be answered from the perspective of an electrical engineer nominated to exercise the statutory function of electrical engineer by a mine operator at a NSW mine.

Electronic aids may not be used, apart from calculators.

All questions are compulsory and candidates must attempt each question.

All questions are of equal value, but parts of questions may vary in value. The marks applicable to each part of a question will be indicated beneath the answer lines.

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 use a highlighter to mark points of importance during the reading time, but may not begin answering the questions. The examination time is three (3) hours. Each whole question is intended to be able to be answered in 15 minutes.

This examination is a closed book examination.

## Question 1 (total 10 marks)

The following questions relate to **AS3007:2013 – Electrical equipment in mines and quarries – Surface installations and associated processing plant.**

- What is the issue with relocatable buildings arriving on your site and what issues may arise when connecting to the mine site power supply? (1 mark)
- What are the risks of a) above? (4 marks)
- To overcome the above issue what should be installed between the supply and the relocatable building? (1 mark)
- What are the special requirements where a 240V supply is an IT system for equipment such as air conditioners, hot water services and lighting services etc.? (2 marks)
- Draw a typical 415/240V 2 phase IT system for the above installation via a centre tap on the 240V winding? (2 marks)

## Question 2 (total 10 marks)

The following questions relate to **AS3760 - In-service safety inspection and testing of Electrical Equipment.**

The mine operator has asked you to review the current site standards of using portable electrical tools and their general inspection and testing requirements.

- Draw a table recommending your site requirements to the mine operator, based on the requirements of AS3760 for the test and inspection intervals for your site.
- The table should indicate the specific requirements for both office and workshop type environments as well as hired equipment. (4 marks)
- List three (3) in service general testing and inspection requirements as described in the standard. (3 marks)
- Based on the requirements of AS3760:2010, write in point form to the mine operator the opportunities that may now exist or differences between your standard and the requirements of AS3760. Detail any reasons for having these differences. (3 marks)

## Question 3 (total 10 marks)

Clause 32 of the *Work Health and Safety (Mines and Petroleum Sites) Regulation 2014* requires the operator of a mine to manage the risks to health and safety associated with electricity.

With regard to this clause of the Regulation:

- Plans need to be in place for the mine electrical reticulation. What are six (6) of these specific requirements? (3 marks)
- What are the four (4) requirements for electrical plant at the mine (other than plant connected, and in close proximity, to a wall socket with a switch)? (2 marks)
- What are the specific requirements around the use of adequately rated switchgear? (2 marks)
- What is the statutory function of the Qualified Electrical tradesperson at the mine as described in schedule 10 of the legislation? (1 mark)
- What are the two (2) requirements that are listed under clause 32 regarding mobile electrical plant fed via trailing or reeling cable? (2 marks)

## Question 4 (total 10 marks)

The following questions relate to **AS3000 Wiring Rules 2007.**

- The fundamental principles of AS3000 describes the three (3) major types of risk. What are they? (3 marks)
- There are four (4) methods of Basic Protection. What are they? (2 marks)
- What are the requirements for accessibility to electrical enclosures and the specific requirements for switch room doors when exiting? (2 marks)
- Explain with the aid of a sketch, how you would test the continuity of the earthing system for a 2.4kW pump installation supplied at 240V and 100m from the MCC? (3 marks)

## Question 5 (total 10 marks)

The following question relates to Uninterruptible Power Supplies (UPS's).

As the Electrical Engineer at a mine, you have a contractor coming on site to replace your existing UPS and battery pack.

- Write a list of your specific requirements, expectations, and concerns you may have that you will provide to a contractor. The list should be in point form and include a brief description of the requirement, expectation, or risks to be dealt with. (6 marks)
- What would you consider being the biggest risk and why? (2 marks)
- Explain whether this would or would not be considered live electrical work. Include your reasons for such a decision as well as how you would progress the task. (2 marks)

## Question 6 (total 10 marks)

You are the Statutory Electrical Engineer when you are advised that a contract electrician has received an electric shock during routine maintenance activities.

- Outline what your first steps would be with respect to this incident. (3 marks)
- What are your responsibilities as far as legislation is concerned? (2 marks)
- What key areas would your investigation focus on? (3 marks)
- Who do you need to notify and in what time periods? (2 marks)

## Question 7 (total 10 marks)

The following question relates to an electric shovel installation supplied via trailing cable from a mobile substation. The shovel will be supplied at 6.6kV.

- Provide a single line drawing for the installation showing all protection devices from the substation to the shovel on board transformer. Detailing any assumptions made (3 marks)
- What commissioning tests would you want performed on the installation prior to placing into service? (3 marks)
- Write an isolation procedure (in point form) to allow access to the slip rings on board the shovel. (4 marks)

## Question 8 (total 10 marks)

The following represents a number of typical electrical engineering scenarios that are encountered in a typical coal operation.

- Determine the full load current on the primary side of the transformer when a 250kW DOL pump motor is installed. The transformer supplying the installation is a 1.5MVA 11kV/415V with an impedance of 5%. Make any necessary assumptions in the calculation. (2 marks)
- You have three 3000KVA transformers with impedances of 5%, 6%, and 7 % respectively. What would be the resultant fault level on the secondary bus when connected in parallel to a 66kV supply with a declared fault level of 375MVA? (2 marks)
- What CT ratio would you expect to be installed for a transformer primary installation that is rated at 4MVA 11kV with 5% impedance? (2 marks)
- Calculate the short circuit current of a 1.5MVA 11kV / 415V transformer which is connected DY11 with an impedance of 5.5%? (2 marks)
- A 66/11kV transformer has a 20A NER fitted (resistor only type rated for a duty of 10s), what would you expect the total resistance of this unit to be? (2 marks)

## Question 9 (total 10 marks)

The following represents a typical dam pump installation on the surface installation.

- Draw a typical dam pump electrical installation that is supplied some 5km from the main substation and supplied by overhead aerials. The drawing should show typical sizes of transformers / motors where applicable. Make any necessary assumptions. (3 marks)

- b) Describe the process you would put in place for personnel to follow in the event that the high voltage circuit breaker feeding the installation had tripped on earth fault. (3 marks)
- c) What would your process describe in the event that the high voltage circuit tripped again during reclosing? (1 mark)
- d) What competency requirements would you put in place on your site for the necessary repairs and maintenance on this type of equipment? (1 mark)
- e) What differences would you have in your process in b) above, if this installation initially tripped on instantaneous overcurrent? (2 marks)

## Question 10 (total 10 Marks)

During your inspection of the workshop's designated welding area, you notice a number of poor work standards with welding equipment.

- a) Prepare an inspection checklist of your top 10 items you want the electrical personnel to check in relation to welding plant across the site as well as the immediate environment that these machines are installed in. (4 marks)
- b) AS1674.2 requires that before welding commences, the work area shall be assessed and the welding environment classified for risk of electric shock. Describe the characteristics of Category A, B, and C environments. (4 marks)
- c) List the recommended control measures to be implemented to prevent electric shock in a Category C environment. (2 marks)

## Question 11 (total 10 marks)

As the Electrical Engineer you have been asked to provide your specific requirements for an automotive specification for mobile plant on the surface.

- a) What would be some of your specific requirements for your specification? Provide your requirements in point form. (4 marks)
- b) List any specific standards / guidelines that you would reference in your specification. (1 mark)
- c) What would you discuss with the manufacturers' representatives regarding the wiring systems to the factory fitted braided covering of the wiring? (2 marks)
- d) Where would you install any emergency stops and what specific requirements would you ask for from the supplier? (1 mark)
- e) What documentation would you insist on being provided prior to accepting the machine? (2 marks)

## Question 12 (total 10 marks)

The mine operator has asked you to apply for an electrical exemption from the *Work Health and Safety (Mines and Petroleum) Regulation 2014*.

- a) Explain in your own words the process you would follow on site before applying for the exemption. (3 marks)
- b) List the documentation you believe you would need to support or accompany the exemption. (3 marks)
- c) Draft a time frame you would expect to prepare the submission and the time for the Department of Planning and Environment to consider such an exemption? (2 marks)
- d) Specifically, who applies for the exemption and who is the application to be addressed to? (2 marks)

## More information

NSW Department of Planning and Environment

Resources Regulator

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## Acknowledgments

Electrical Engineer Examination Panel

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Disclaimer: The information contained in this publication is based on knowledge and understanding at the time of writing (July 2017). However, because of advances in knowledge, users are reminded of the need to ensure that information upon which they rely is up to date and to check currency of the information with the appropriate officer of the NSW Department of Planning and Environment or the user's independent advisor.

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