Department of Industry
Resources & Energy

Mine Safety

EXAMINATION REPORT | CERTIFICATE OF COMPETENCE

Electrical engineering manager of underground coal mines

Electrical engineer of coal mines other than underground coal mines

September - November 2015

Summary of results and general comments

Closing date:	24 July 2015
Number of applicants:	13 (12 approved to sit)

Written examination

Date:	16 September 2015
Number of candidates:	12
New candidates:	9
Candidates re-sitting:	3
Candidates eligible to sit oral examination (underground):	1
Candidates eligible to sit oral examination (surface):	1

CEE1 – Application of electrical engineering to mining

Number of candidates:	6
Number who passed:	1 (17% success rate) (1 candidates passed from 4 candidates on 1st attempt = 25%)
Total marks available:	60 (all questions of equal value – 10 marks each)
Pass mark:	36/60 (60%)
Average overall mark:	49%
Minimum mark obtained:	23.5
Maximum mark obtained:	44

Question 1

Minimum mark	Maximum mark	Average mark
4/10	10/10	6/10

Comments: This question was answered moderately well. The key dates were 24 months for the electrical control plan, and 1st October 2015 for manufacture of MDA-approved equipment. Some candidates discussed the role and powers of the electrical check inspector. No one discussed the fact that following an incident, the industry check inspector had to release the site along with the Inspector. More understanding of the *Work Health and Safety (Mines) Act* and corresponding regulation is recommended. Report style writing was poor.

Question 2

Minimum mark	Maximum mark	Average mark
1.5/10	10/10	5.5/10

Comments: Candidates generally did not grasp the question and their answers were not focused on the immediate needs. They tended to generalise and tried to cover too much area.

Question 3

Minimum mark	Maximum mark	Average mark
3/10	9/10	6/10

Comments: The electrical engineering manager is expected to have a sound knowledge of functional safety. Many candidates gave an SIL 2 rating when SIL 1 was sufficient. Increasing the proof testing of the over-pressure protection system will lead to an increase in its probability of failure on demand. No one discussed that the effect could be an increase in risk of injury. The question was new and marked with leniency.

Question 4

Minimum mark	Maximum mark	Average mark
1.5/10	8/10	5.5/10

Comments: The question focused on electrical systems and equipment in terms of the Work Health and *Safety Regulation 2011.* Candidates generally answered question quite poorly and this was disappointing as the area should be regarded as essential knowledge for electrical engineer roles in NSW mines.

Question 5

Minimum mark	Maximum mark	Average mark
2.5/10	7/10	4/10

Comments: This question focused on AS/NZS3800 and licence requirements under the Work Health and *Safety (Mines) Regulation 2014*. Candidates generally answered this question poorly and failed to identify that a licence is only required for equipment repairs for underground coal mines. It is the responsibility of the mine operator to ensure only a licenced facility is used.

Question 6

Minimum mark	Maximum mark	Average mark
1/10	7/10	3/10

Comments: Candidates failed to understand how to apply basic electrical engineering principles with regard to fault calculations and voltage drop application.

CEE2 – Legislation and standards applicable to underground coal mines

Number of candidates:	6
Number who passed:	1 (17% success rate)
	(1 candidates passed from 4 candidates on 1st attempt = 25%)
Total marks available:	120 (all questions of equal value – 10 marks each)
Pass mark:	72/120 (60%)
Average overall mark:	48.5%
Minimum mark obtained:	33.5
Maximum mark obtained:	74

Question 1

Minimum mark	Maximum mark	Average mark
4.5/10	8/10	7/10

Comments: There was a wide range of results considering Exd (Explosive protection flameproof) is a key aspect of the role of an electrical engineering manager. Some answered the question with direct quotes from hazardous area training and not as per the AS/NZS 60079.1 standard, as the question had required.

Question 2

Minimum mark	Maximum mark	Average mark
0/10	4/10	1.5/10

Comments: Most candidates did not appear to know the answer and tried to generalise.

Question 3

Minimum mark	Maximum mark	Average mark
1.5/10	10/10	7/10

Comments: This question was very poorly answered by most candidates. This is disappointing as knowledge of the principles underpinning all work health and safety legislation in NSW is essential to the role of electrical engineering manager.

Question 4

Minimum mark	Maximum mark	Average mark
0.5/10	7.510	5.5/10

Comments: Candidates generally answered this question poorly. The identified “hazards” should have been more widely recognised. Responses to the portable electrical apparatus component were reasonably managed.

Question 5

Minimum mark	Maximum mark	Average mark
4/10	7/10	5/10

Comments: Compliance to the standard is mandatory for maintenance of applied equipment. Candidates generally did not appear to have read the standard and answered questions based on other training or experience.

Question 6

Minimum mark	Maximum mark	Average mark
2.5/10	7/10	5/10

Comments: This question was taken directly from the Work Health and Safety (Mines) Regulation 2014. It was disappointing to see such a poor demonstration of knowledge of the requirements regarding methane monitoring, which is a critical concern for underground engineers.

Question 7

Minimum mark	Maximum mark	Average mark
3.5/10	8.5/10	6/10

Comments: AS/NZS 3800 is a key standard for the management of Ex (Explosive protection) equipment. This question was answered at an acceptable level overall. However, the parts relating to over-pressure testing were not answered well and few candidates appeared to know what pressure was required, and for how long. More work is required to achieve a better understanding of this standard

Question 8

Minimum mark	Maximum mark	Average mark
3/10	7/10	4.5/10

Comments: Candidates failed to understand the specific requirements of AS4871.1 and the application of interlocking system and hazards associated with access to equipment.

Question 9

Minimum mark	Maximum mark	Average mark
4.5/10	9/10	7/10

Comments: There was a wide scope of answers to this question – this regulation should be well understood to develop the Electrical Control Plan. Candidates should be getting 9 or 10’s for this type of question, but most answered poorly.

Question 10

Minimum mark	Maximum mark	Average mark
1/10	5/10	3/10

Comments: Most candidates failed to be able to demonstrate their knowledge of legislative and Australian Standard requirements for electrical installations on and around construction sites.

Question 11

Minimum mark	Maximum mark	Average mark
1/10	6.5/10	3.5/10

Comments: The question was answered poorly and candidates didn’t understand the curve application directly from the standard. Most diagrams presented were of a poor standard.

Question 12

Minimum mark	Maximum mark	Average mark
3/10	5.5/10	3.5/10

Comments: In general, this question was very poorly answered The parts of the question were not technically challenging – use of associated apparatus and concepts of simple devices are covered in EEHA training.

CEE3 – Legislation and standards applicable to surface coal mines

Number of candidates:	5
Number who passed:	1 (20% success rate) (1 candidates passed from 5 candidates on 1st attempt = 20%)
Total marks available:	120 (all questions of equal value – 10 marks each)
Pass mark:	72/120 (60%)
Average overall mark:	49.5%
Minimum mark obtained:	42.5
Maximum mark obtained:	85.5

Question 1

Minimum mark	Maximum mark	Average mark
2/10	4.5/10	3/10

Comments: Candidates failed to understand the specific requirements of AS4871.1 and the application of interlocking system and hazards associated with access to equipment.

Question 2

Minimum mark	Maximum mark	Average mark
2/10	5/10	4/10

Comments: Most candidates failed to be able to demonstrate their knowledge of legislative and Australian Standard requirements for electrical installations on and around construction sites.

Question 3

Minimum mark	Maximum mark	Average mark
0/10	10/10	6.5/10

Comments: Most candidates knew these important sections of the legislation. One candidate appeared to have no understanding at all, and this is of significant concern.

Question 4

Minimum mark	Maximum mark	Average mark
1/10	6/10	2.5/10

Comments: Candidates failed to understand how to apply basic electrical engineering principles with regard to fault calculations and voltage drop application.

Question 5

Minimum mark	Maximum mark	Average mark
2/10	8/10	4/10

Comments: This question was answered moderately well. The key date was 24 months for the electrical control plan. Some candidates discussed the role and powers of the electrical check inspector. No one discussed the fact that following an incident, the industry check inspector had to release the site along with the Inspector. More understanding of the *Work Health and Safety (Mines) Act* and corresponding regulation is recommended. Report style writing was poor.

Question 6

Minimum mark	Maximum mark	Average mark
1.5/10	6.5/10	4.5/10

Comments: The question was generally answered quite poorly and candidates were unable to demonstrate practical application of duty of care obligations under work health and safety laws in NSW. The question should not have posed a problem for candidates who understood the legislation.

Question 7

Minimum mark	Maximum mark	Average mark
2/10	8/10	5/10

Comments: The responses ranged from poor to reasonable. Electrical engineers require a detailed knowledge of Australian Standards and legislation that relates to their role.

Question 8

Minimum mark	Maximum mark	Average mark
1.5/10	4.5/10	3/10

Comments: The candidates answered the requirements of AS4136 with respect to live testing quite poorly, particularly given it has been a well-publicised topic in the last couple of years.

Question 9

Minimum mark	Maximum mark	Average mark
4/10	10/10	5.5/10

Comments: The electrical engineer is expected to have a sound knowledge of functional safety. Many gave it a SIL 2 rating when SIL 1 was sufficient. Increasing the proof testing of the over-pressure protection system will lead to an increase in its probability of failure on demand. No one discussed that the effects could be an increase in risk of injury. The question was new and marked with leniency.

Question 10

Minimum mark	Maximum mark	Average mark
5.5/10	9.5/10	7.5/10

Comments: There was a wide scope of answers to this question – this regulation should be well understood to develop the Electrical Control Plan. Candidates should be getting 9 or 10’s for this type of question, but most answered poorly.

Question 11

Minimum mark	Maximum mark	Average mark
1/10	10/10	7/10

Comments: Candidates generally did not grasp the question and their answers were not focused on the immediate needs. They tended to generalise and tried to cover too much area.

Question 12

Minimum mark	Maximum mark	Average mark
4.5/10	9/10	6.5/10

Comments: Mining cables and related testing procedures were generally not well understood. The candidates who knew their work handled the question easily and scored high marks. The others had very low results.

Oral examination results

Date:	18 November 2015
Number of candidates:	4
New candidates:	2
Candidates re-sitting:	2

Examination questions

Question 1

Used for both open-cut and underground candidates.

The question was related to protection settings and fault levels in relation to mine reticulation systems. A process of how this is achieved via legislative requirements, through the Electrical Engineering Control Plan process and associated standards.

Candidates need to understand why fault levels are undertaken and how their specific results are achieved in practice. Candidates also need to understand how these measures are managed with regard to changes in production machines, such as by shortening or lengthening cables.

Discussion also considered commissioning and notification processes for the Electrical Engineer Manager/Electrical Engineer.

Question 2

Used for both open-cut and underground candidates.

The candidates were asked to outline high voltage isolation processes for two different scenarios. They were provided with an 11kV single line diagram for this. Candidates were expected to correctly identify isolation points, placement of earths and why earths needed to be applied. Candidates were asked to explain what would be required to be included on an access permit.

Candidates were also asked to explain how they would safely connect a generator to an MCC while the incoming high voltage supply was isolated.

Question 3

Used for underground candidates only.

This question related to the underground hazardous zone, cable damage and in-service failure of Exd equipment. The question covered the notification process and reporting requirements, including the investigation process required for this type of incident.

The process to make the equipment available for operations was required to be identified by the candidate. This process needed to occur without compromising any standards. The candidates were asked to respond to the situation if short-term hired equipment was in use and discuss the processes failures that might have occurred leading to the situation (such as maintenance, inspection and acceptance to site processes).

Candidates needed to be able to identify a long-term approach to preventing this type of incident from re-occurring.

Question 4

Used for underground candidates only.

This question related to explosion-protected plant. This type of equipment is a critical risk control in underground mines. Candidates were asked to explain their understanding of the term ‘life-cycle of plant’.

The question was then expanded to discuss the process of overhauling an item of Ex plant. This included the development of the scope of work for the overhaul and what inputs would need to be used to develop the work scope.

Discussion then considered who would overhaul the Ex plant and how the electrical engineering manager could ensure the workshop was capable of conducting the work and where the correct information could be found to support their decisions. Overhaul and repair did not appear to be well understood.

Question 5

Used for open-cut candidates only.

Candidates were asked about the electrical control plan – what the key elements of it were and who was responsible for it. The elements of the control plan were discussed which lead into uncontrolled fires on the haul trucks. Candidates were asked to discuss what could be done to reduce the risk of such fires. The question was well answered.

Question 6

Used for open-cut candidates only.

Candidates were asked about an open-cut mine with two feeders from the main switch yard going to transportable sub-stations in the mine. Candidates were advised of an earth leakage trip in the switch yard and were asked to describe the process for investigation.

Candidates were advised that during the investigation, it was established that a cable in the pit had been run over and this had caused the failure as it had caused an upstream trip.

Cable standards were reviewed with candidates and discussion focussed on the standards and rules applied in mines.

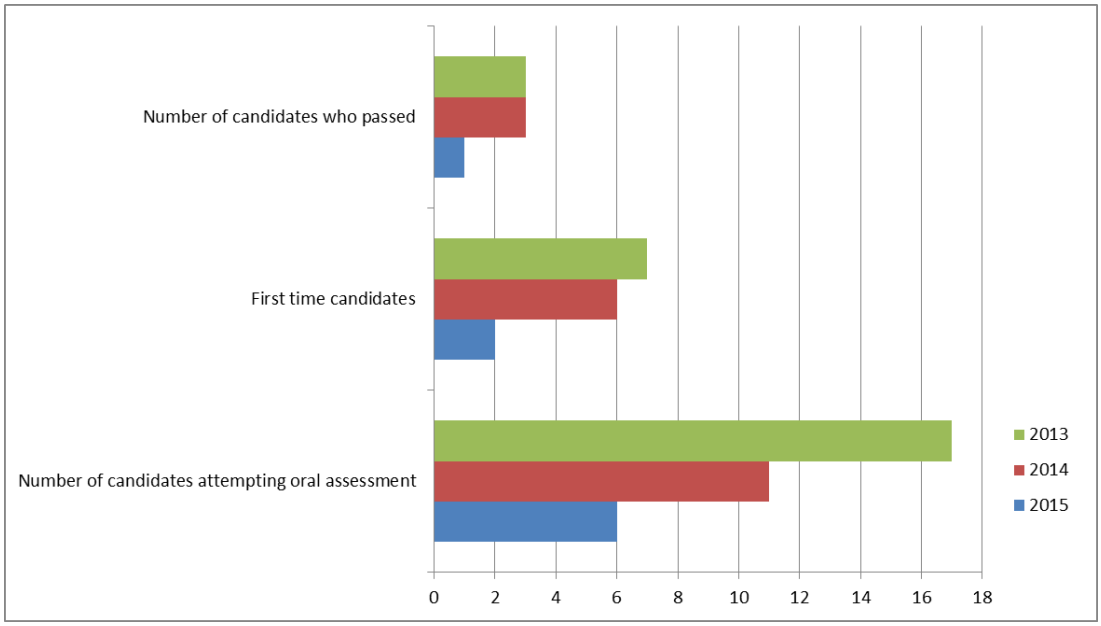
Convenor's final comments

The views of the examiners were that the candidates that did the work before both the written and the oral reaped the rewards. The overall result for the industry was poor and industry should start to look at what it can do to assist candidates prepare for both the written and oral.

Candidates need to be prepared to answer questions as if they were working within the statutory role. It is no longer enough to go into the examinations using the practice of 'study to pass the exam'. Candidates need to have a sound understand of the engineering behind what the practices of the position entails. The examiner believes that this has always been the case and the examination process has always reflected the changing industry.

Feedback will be given by the competence unit for those who wish to obtain it, and an industry briefing session will be planned for the first quarter of 2016.

Fig 1: Details of the outcome of oral assessments over the last three years.



More information

Business Processes and Authorisations Unit – 02 4931 6625

Acknowledgments

Electrical engineering manager / Electrical engineer examination panel.

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