

EXAMINATION PAPER

Electrical engineering manager 2020

Electrical engineering manager of underground coal mines certificate of competence

CEE 1 – Application of electrical engineering to mining

Written examination held 15 September 2020

Instructions to candidates

Unless otherwise stated all references to the Act, Regulations and Standards 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 2014
- Australian Standards.

Question 1

You are the Electrical Engineering Manager (EEM) at an underground coal mine and you have been tasked with the construction of a new 15km long 66kV power transmission line for a remote substation. The transmission line also includes an underslung 11kV line which terminates halfway along for a workshop.

The transmission line runs parallel to a conveyor for approximately 5km and there are several road crossings.

- a) Considering the whole life cycle of the transmission line, describe all hazards that could arise due to induction. (2 Marks)
- b) Considering the whole life cycle of the transmission line, describe all hazards that could arise due to inadequate clearances. (2 Marks)
- c) What earthing arrangements would need to be considered for the transmission line? (2 Marks)
- d) What would you include in an annual inspection plan for the transmission line? (2 Marks)
- e) What standards would you consider for the design of the transmission line? (2 Marks)

Question 2

As the Electrical Engineering Manager (EEM) at an underground coal mine, you have been advised by the original equipment manufacturer (OEM) for the Exd certified VVVF Drives on your longwall AFC that they have identified a manufacturing fault which may prevent the filter capacitors from discharging. Replacement components to rectify this issue should be shipped from the factory within 28 days.

- a) What hazards may this fault present to workers? (2 marks)
- b) With this fault, will the Exd VVVF Drives be compliant with the WHS(M&PS) Regulation 2014? Explain your answer. (2 marks)
- c) The mine cannot allow the longwall to remain idle for an extended period due to poor strata conditions. Discuss what actions you could take to achieve continued compliant and safe operation? (6 marks)

Question 3

You are the Electrical Engineering Manager (EEM) at an underground longwall operation and the mine is planning for a longwall relocation. To support the relocation, short term contract electricians will be employed, and additional mobile plant will be brought to site.

- a) Describe the process you will have in place to ensure the safe operation of the hired mobile plant. (4 marks)
- b) Nominate the competencies you require the contract electricians to have, and how you will satisfy yourself they meet these requirements? (4 marks)
- c) Describe the supervision arrangements for the contract electricians. (2 Mark)

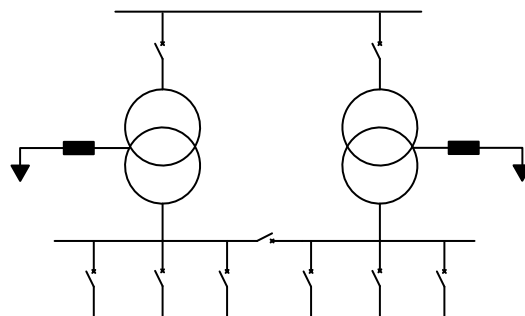
Question 4

You are the Electrical Engineering Manager (EEM) at an underground coal mine that is transitioning from a cut flit operation and introducing longwall mining. This change will significantly alter the maximum power demand placed on the electrical infrastructure.

With respect to the existing electrical distribution network, discuss the five (5) most critical electrical infrastructure changes that will need to be addressed in order to make this major change to the mine. (2marks for each section, 10 Mark in total)

Question 5

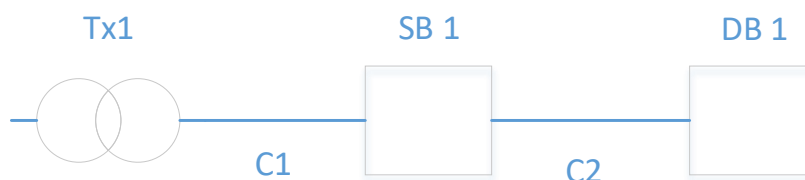
Your high voltage switch yard has two (2) 33/11kV 5MVA transformers each feeding three (3) 11kV circuit breakers. The transformers are each fitted with 10 Amp NERs.



Discuss five (5) things to be considered before closing the bus tie for the first time. (2 marks each)

Question 6

You are the Electrical Engineering Manager (EEM) at an underground coal mine. The mines surface facilities are being upgraded with a new transformer, main switchboard and local distribution board.



Installation technical details

- Transformer (Tx1) – 1600kVa 11Kv to 433v with an impedance 6%
- Cable C1 has length 25m, using single core 120mm² active conductors and 70mm² neutral
- Cable C2 had a route length 35m using a 16mm² multicore cable. Note any assumptions you have made
- SB (Switch/distribution board)

- Cable specifications as per AS/NZS3008.1.1:20017 (Tables 34 & 35)

TABLE 34
a.c. RESISTANCE (R_c) AT 50 Hz

CABLE TYPE: SINGLE-CORE

1	2	3	4	5	6	7	8	9	10	11	12
Conductor size mm ²	a.c. resistance (R_c) at 50 Hz, Ω /km										
	Copper*						Aluminium				
	Conductor temperature, °C						Conductor temperature, °C				
	45	60	75	80	90	110	45	60	75	80	90
1	23.3	24.5	25.8	—	27.0	28.7	—	—	—	—	—
1.5	14.9	15.7	16.5	—	17.3	18.4	—	—	—	—	—
2.5	8.14	8.57	9.01	—	9.45	10.0	—	—	—	—	—
4	5.06	5.33	5.61	—	5.88	6.24	—	—	—	—	—
6	3.38	3.56	3.75	3.81	3.93	4.17	—	—	—	—	—
10	2.01	2.12	2.23	2.26	2.33	2.48	—	—	—	—	—
16	1.26	1.33	1.40	1.42	1.47	1.56	2.10	2.22	2.33	2.37	2.45
25	0.799	0.842	0.884	0.899	0.927	0.984	1.32	1.39	1.47	1.49	1.54
35	0.576	0.607	0.638	—	0.668	0.710	0.956	1.01	1.06	1.08	1.11
50	0.426	0.448	0.471	—	0.494	0.524	0.706	0.745	0.783	0.796	0.822
70	0.295	0.311	0.327	—	0.342	0.363	0.488	0.515	0.542	0.551	0.568
95	0.213	0.225	0.236	—	0.247	0.262	0.353	0.372	0.392	0.398	0.411
120	0.170	0.179	0.188	—	0.197	0.208	0.279	0.295	0.310	0.315	0.325
150	0.138	0.145	0.153	—	0.160	0.169	0.228	0.240	0.253	0.257	0.265
185	0.111	0.117	0.123	—	0.129	0.136	0.182	0.192	0.202	—	0.212
240	0.0862	0.0905	0.0948	—	0.0991	0.105	0.140	0.147	0.155	—	0.162
300	0.0703	0.0736	0.0770	—	0.0803	0.0846	0.113	0.119	0.125	—	0.130
400	0.0569	0.0595	0.0620	—	0.0646	0.0677	0.0890	0.0936	0.0981	—	0.103
500	0.0467	0.0487	0.0506	—	0.0525	0.0547	0.0709	0.0744	0.0779	—	0.0813
630	0.0389	0.0404	0.0418	—	0.0432	0.0448	0.0571	0.0597	0.0623	—	0.0649

* For the a.c. resistance of tinned copper conductor, multiply copper value by 1.01.

TABLE 35
a.c. RESISTANCE (R_c) AT 50 Hz

CABLE TYPE: MULTICORE WITH CIRCULAR CONDUCTORS

1	2	3	4	5	6	7	8	9	10
Conductor size	a.c. resistance (R_c) at 50 Hz, Ω/km								
	Copper*					Aluminium			
	Conductor temperature, $^{\circ}\text{C}$					Conductor temperature, $^{\circ}\text{C}$			
	mm^2	45	60	75	90	110	45	60	75
1	23.3	24.5	25.8	27.0	28.7	—	—	—	—
1.5	14.9	15.7	16.5	17.3	18.4	—	—	—	—
2.5	8.14	8.57	9.01	9.45	10.0	—	—	—	—
4	5.06	5.33	5.61	5.88	6.24	—	—	—	—
6	3.38	3.56	3.75	3.93	4.17	—	—	—	—
10	2.01	2.12	2.23	2.33	2.48	—	—	—	—
16	1.26	1.33	1.40	1.47	1.56	2.10	2.22	2.33	2.45
25	0.799	0.842	0.884	0.927	0.984	1.32	1.39	1.47	1.54
35	0.576	0.607	0.638	0.669	0.710	0.956	1.01	1.06	1.11
50	0.426	0.449	0.471	0.494	0.524	0.706	0.745	0.784	0.822
70	0.295	0.311	0.327	0.343	0.364	0.488	0.515	0.542	0.569
95	0.214	0.225	0.236	0.248	0.262	0.353	0.373	0.392	0.411
120	0.170	0.179	0.188	0.197	0.209	0.280	0.295	0.310	0.325
150	0.139	0.146	0.153	0.160	0.170	0.228	0.241	0.253	0.265
185	0.112	0.118	0.123	0.129	0.136	0.182	0.192	0.202	0.212
240	0.0870	0.0912	0.0955	0.0998	0.105	0.140	0.148	0.155	0.162
300	0.0712	0.0745	0.0778	0.0812	0.0852	0.113	0.119	0.125	0.131
400	0.0580	0.0605	0.0630	0.0656	0.0685	0.0897	0.0943	0.0988	0.103
500	0.0486	0.0506	0.0525	0.0544	0.0565	0.0730	0.0765	0.0800	0.0835

* For the a.c. resistance of tinned copper conductor, multiply copper value by 1.01.

- Calculate the prospective fault current at Tx1 433V Bus. (2 Marks)
- Calculate the Prospective fault current at the Main Switch Board SB1 (3 Marks)
- Calculate the Prospective fault Current at the Distribution Board DB1 (3 Marks)
- You are considering converting the earthing system to an IT, what would the resistance value be for a 5 Amp NER at TX1? (2 Marks)

Electrical engineering manager of underground coal mines certificate of competence

CEE2 – Legislation and standards applicable to underground coal mines

Written examination held 15 September 2020

Instructions to candidates

Unless otherwise stated all references to the Act, Regulations and Standards 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 2014
- Australian Standards.

Question 1

With reference to AS/NZS3800:2012 *Electrical equipment for explosive atmospheres - Repair and overhaul* and the licencing requirements under the Workplace Health and Safety (Mines and Petroleum Sites) Regulations 2014:

- a) Who is responsible for ensuring an underground coal mine only uses a workshop licenced to undertake overhauls of explosion-protected electrical equipment? (1 mark)
- b) Can a workshop in Victoria overhaul Ex d (flameproof) electrical equipment for a NSW UG coal mine? Explain your answer. (1 mark)
- c) Can a workshop with a licence to overhaul Ex d (flameproof) equipment, overhaul any item of equipment marked Ex(d)(e)(m) for NSW UG coal mine? (1 mark)
- d) Can an Original Equipment Manufacturer (OEM) of a piece of explosion-protected electrical equipment, overhaul equipment if the OEM does not have a licence? (1 mark)
- e) According to AS/NZS3800:2012 – Where an overhaul facility cannot overhaul an item of Group 1 explosion protected equipment against its certification, and instead overhauls it against the standard it was certified to, how should this equipment be marked? (1 mark)
- f) According to AS/NZS3800:2012 – When a pressure test is required, and a reference pressure is not stated on a certificate of conformity for an item of Ex d (flameproof) plant, what pressure should the enclosure be tested at, and for how long? (1 mark)
- g) According to AS/NZS3800:2012 – Where it is proposed to alter an Ex d enclosure by replacing an internal component such as a contactor with a replacement of a different type and dimensions, what should be done? (2 marks)
- h) According to AS/NZS3800:2012 – What should be included in the job report prepared for the end user? (2 marks)

Question 2

With respect to explosion protected electrical equipment:

- a) What is *pressure piling*? (2 marks)
- b) What is *associated apparatus*? (2 marks)
- c) What does the marking code *Ex d I Mb* mean? (2 marks)
- d) What is meant by the terms *system* and *entity* concepts with respect to intrinsically safe apparatus? (2 marks)
- e) Describe what a *Zone 20* classification means. (2 marks)

Question 3

When preparing an electrical engineering control plan the operator must consider *the reliability of electrical safeguards used at the mine or petroleum site to protect persons from electrical or other hazards.*

With respect to a new coal clearance conveyor:

- a) How will you determine if there are any electrical safeguards required to protect persons? (2 marks)
- b) How will you determine the level of reliability required to protect persons? (2 marks)
- c) The conveyor is fitted with a lanyard and pull key emergency stop system. What critical commissioning checks will you make to ensure its effectiveness? (4 marks)
- d) The following abbreviations are common terms used in the safety standards. What do each of the abbreviations stand for? (1/2 marks each)
 - i. EUC - ...
 - ii. PES -
 - iii. SRCF -
 - iv. MTBF -

Question 4

As the Electrical Engineering Manager (EEM) for an underground coal mine, you are required to manage the effects of Lightning on your site.

Australian Standard *AS/NZS 1768 Lightning Protection*, introduces the concept of following a risk management approach to determine the requirement for lightning protection for people and equipment.

You are developing your own Lightning Management Plan for the site:

- a) Please identify five (5) significant hazards caused by a direct or indirect lightning strike at your site. (1 mark each)
- b) For each of the hazards identified above, describe the most significant control to mitigate that risk, (1 mark each)

Question 5

AS/NZS 60079.25 Intrinsically safe electrical systems contains specific requirements for construction and assessment of I.S systems.

a) Connect the devices below (*Figure 1*) to form a simple intrinsically safe circuit. (2 marks)

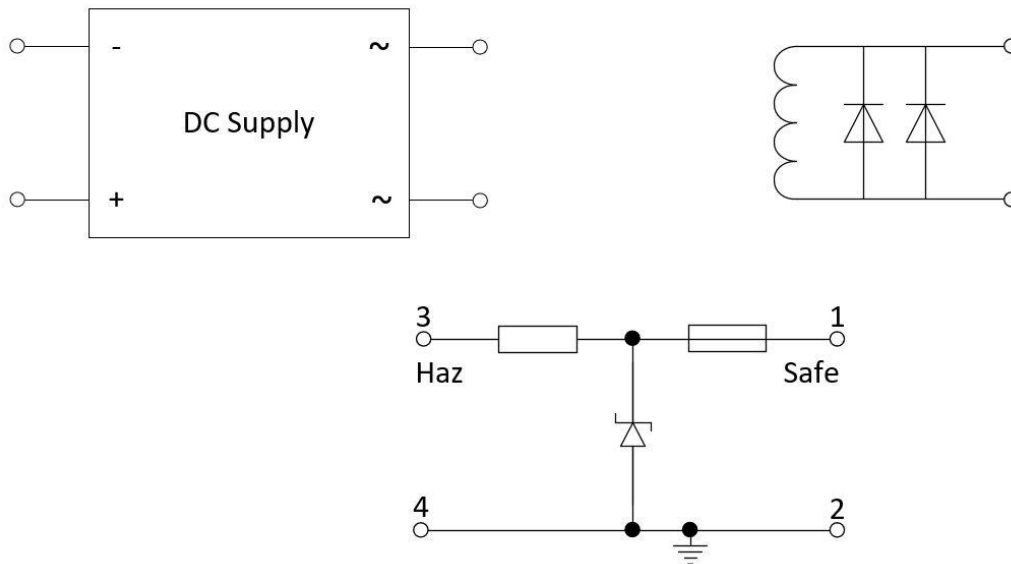


Figure 1

b) To achieve a compliant intrinsically safe system in the intrinsically safe circuit shown below (*figure 2*); (2 marks)

U_i must be than 24 Volts

and I_o must be than 500mA. (2 marks)

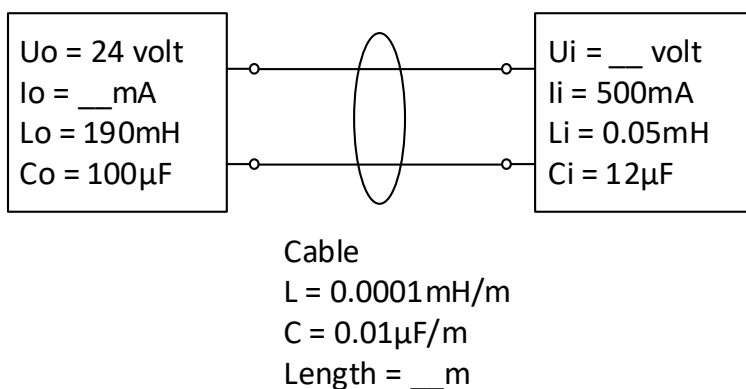


Figure 2

c) What is the maximum compliant cable length for the intrinsically safe circuit shown above (*Figure 2*)? Show all working (4 marks)

d) Describe the difference between an Isolation Barrier and a Diode Safety Barrier. (2 marks)

Question 6

Schedule 10 of the Work Health and Safety (Mines and Petroleum Sites) Regulation 2014 describes the functions of the statutory positions at mines.

Fill in the missing words. (1/2 mark each. Note: each number is one word).

a) The statutory functions of electrical engineering manager are:

to ____1____, ____2____, monitor and ____3____ the electrical engineering standards and ____4____ forming part of mining operations at the mine, and to ____5____ the installation, ____6____, maintenance and repair of electrical ____7____ and installations at the mine.

The requirement for nomination to exercise the statutory functions is that the individual nominated must hold a current ____8____ ____9____ that authorises the exercise of the ____10____ functions.

Write your answer below (5 marks)

b) The statutory function of qualified electrical tradesperson is:

to ____11____ the ____12____, commissioning, ____13____ and ____14____ of electrical plant and installations at the mine.

The requirement for nomination to exercise the statutory function is that the individual nominated must—

have a ____15____ ____16____ that authorises the doing of electrical ____17____ work, or

have a ____18____ certificate (issued by State Training Services) in an electrical trade, or

have been _____19_____ employed as an electrical _____20_____ at a coal mine since 21 December 2004.

Write your answer below (5 marks)

Question 7

For the following explosion protection techniques, describe the attributes that are designed to prevent the ignition of an explosive atmosphere.

- Type of protection *Ex i* (2 marks)
- Type of protection *Ex e* (2 marks)
- Type of protection *Ex d* (2 marks)
- Type of protection *Ex m* (2 marks)
- Give an example where explosion protection techniques *Ex d* and *Ex e* may be used together. (2 marks)

Question 8

Clause 78(4) of the Work Health and Safety (Mines and Petroleum Sites) Regulation 2014 states;

The mine operator of an underground coal mine must ensure that any electrical plant used in a hazardous zone is maintained and overhauled in accordance with Australian and New Zealand Standard AS/NZS 2290.1:2014 Electrical equipment for coal mines—Introduction, inspection and maintenance—Part 1: For hazardous areas.

Your mine's parent company is proposing that all its sites extend the overhaul frequency for distribution control boxes (DCBs) and shuttle cars from 4 years to 6 years.

- Considering the legislated requirements, discuss the process you would follow, and the specific items you would need to address when determining the impact of the proposal on the safety of explosion protected electrical plant at your site. (5 marks)
- AS/NZS 2290.1:2014 Electrical equipment for coal mines—Introduction, inspection and maintenance—Part 1: For hazardous areas* states repairs and reclamation of equipment will be carried out in accordance with what standard? (1 mark)
- What Australian Standard describes a competency framework for the inspection and maintenance of explosion protected electrical equipment? (1 mark)

AS/NZS 2290.1:2014 Electrical equipment for coal mines—Introduction, inspection and maintenance—Part 1: For hazardous areas states repairs in situ that affect the explosion protection technique of the

equipment shall be documented, authorised and carried out by persons with recognised competencies. It also states three additional criteria;

Care shall be exercised to ensure that a repair completed in situ – (complete the following statements) (1 mark each)

- a) *does not*
- b) *provides a*.....
- c) *is followed*.....

Question 9

Defining and managing risk controls.

- a) Identify two (2) critical preventative electrical engineering controls for the prevention of conveyor fires, that you require to be implemented in the design of a new underground conveyor. For each of the controls nominated define;
 - i. control one objective: (2 marks)
 - ii. How will you ensure control one (above) remains effective throughout the life of the conveyor? (2 marks)
 - iii. control two objective: (2 marks)
 - iv. How will you ensure control two (above) remains effective throughout the life of the conveyor? (2 marks)

Question 10

As the Electrical Engineering Manager at an underground coal mine (EEM), you are reviewing a risk assessment that had been conducted for fire or explosion risks in the mines new reclaim tunnel.

Hazard	Potential Incident	Current Controls	L	C	R	Recommended Controls
1. Coal dust in suspension	a)	●●●●●●●●●●	●	●	●	b)

2. Coal dust in layers	c)	●●●●●●●●●●	●	●	●	d)
3. Methane gas	e)	●●●●●●●●●●	●	●	●	f)
4. Electrical cables & fittings	g)	●●●●●●●●●●	●	●	●	h)
5. Confined space	i)	●●●●●●●●●●	●	●	●	j)

For each of the hazards identified, detail the Potential Incident and the Recommended Controls to be put in place to prevent the incident occurring. (1 mark each)

Question 11

The Work Health and Safety (Mines and Petroleum Sites) Regulation 2014, Schedule 2, nominates matters to be addressed in the Electrical engineering control plan. Describe how electrical protection relates to each of the matters listed below.

- a) What is the relationship of electrical protection to - *“the reliability of electrical safeguards used at the mine or petroleum site to protect persons from electrical or other hazards”*? (2 marks)
- b) What is the relationship of electrical protection to - *“the rating and design of plant for the prospective electrical fault level, electrical load, arc fault control”*? (2 marks)
- c) What is the relationship of electrical protection to - *“the occurrence of uncontrolled fires”*? (2 marks)
- d) What is the relationship of electrical protection to - *“the prospective touch, step and transfer voltage”*? (2 marks)
- e) What is the relationship of electrical protection to - *“variations in operating conditions,”*? (2 marks)

Question 12

Multiple choice questions. Circle the most correct answer (1/2 mark each)

- a) Ignition temperature is
 - i. the temperature that a substance will ignite and sustain combustion when exposed to a spark or flame

- ii. the temperature of an incendive spark
 - iii. the minimum temperature required to sustain an arc flash
 - iv. the minimum temperature that a substance will ignite and sustain combustion without initiation by spark or flame.
- b) With respect to hazardous area classifications, Zone 2 would be an area where
- i. an explosive dust atmosphere may occur in normal operation
 - ii. an explosive gas atmosphere is not likely to occur in normal operation
 - iii. an explosive dust atmosphere is not likely to occur in normal operation
 - iv. both ii and iii above
- c) Equipment certified to equipment protection level 'Mb' is
- i. only suitable for Queensland coal mines
 - ii. suitable for use in NSW coal mine hazardous zone if methane in the general body of the air in that zone is less than 2% by volume
 - iii. suitable for use in NSW coal mine hazardous zone if methane in the general body of the air in that zone is less than 1.25% by volume
 - iv. not recognised under NSW WHS(M&PS) Regulation 2014
- d) For Group 1 applications, AS/NZS IEC 60079.1:2015 nominates that the maximum flame path gap for an enclosure with a minimum joint length (L) of 12.5 mm is
- i. 0.5 mm
 - ii. 0.35 mm
 - iii. 0.4 mm
 - iv. 0.3 mm
- e) Group II associated apparatus is
- i. not permitted for use in a hazardous zone at a NSW underground coal mine

- ii. is for hydrogen gas atmospheres only
 - iii. permitted for use in a hazardous zone at a NSW underground coal mine
 - iv. only suitable for explosive mixtures of fibres or dust
- f) The terminals for separate intrinsically safe circuits shall be separated by at least what distance?
- i. 6 mm
 - ii. 50 mm
 - iii. 3 mm
 - iv. 30 mm
- g) The WHS Regulation 2017 states that:
- a person conducting a business or undertaking must ensure the following before electrical work on energised electrical equipment commences, a risk assessment is conducted -*
- i. to establish the need to undertake work on energised electrical equipment
 - ii. in relation to the proposed electrical work
 - iii. to determine the minimum competencies required for energised work
 - iv. to establish emergency procedures
- h) S/NZS 3000 Wiring Rules fundamental principles are to protect against the dangers of
- i. unauthorised wiring and installation practices
 - ii. inadequate electrical protection
 - iii. voltage and currents
 - iv. shock current, excessive temperatures & explosive atmospheres
- i) AS/NZS 3000 Wiring Rules state that live parts shall be inside enclosures or behind barriers that provide a degree of protection of at least -
- i. IP2X & IP4X for readily accessible horizontal top surfaces
 - ii. IP22 for all accessible locations

- iii. IP2X for all readily accessible surfaces
 - iv. IP3X for all readily accessible surfaces
- j) AS/NZS 3000 Wiring Rules Clause 8.3.3 describes the mandatory tests for low voltage installations. Some of these tests include -
- i. earth continuity, MEN link labelling, earth loop impedance, circuit breaker operation
 - ii. circuit breaker operation, insulation resistance, wiring colour code, earth continuity
 - iii. circuit cross connections, phase rotation, IP rating
 - iv. earth continuity, operation of RCDs, polarity, insulation resistance
- k) AS/NZS4024:3611 *Belt conveyors for bulk material handling* states a protective stop control shall be fitted to detect slippage between every independently driven pulley and the belt. This device shall automatically bring the belt to a stop if the slip -
- i. 30 seconds after starting exceeds 10%
 - ii. exceeds 10% of the conveyors intended speed for not greater than 4 seconds
 - iii. exceeds 20%
 - iv. exceeds 10% of the conveyors intended speed 30 seconds after starting
- l) AS/NZS4024:3611 *Belt conveyors for bulk material handling* states where a hazard may result from the overheating of a pulley or high-speed gearbox bearing, devices should be installed to detect the overheating. The bearing over temperature control should be set to trip at -
- i. 150 degrees Celsius
 - ii. the bearing manufacturers recommended setting
 - iii. No greater than 105 degrees Celsius
 - iv. no greater than 20% normal operating temperature

- m) The WHS(M&PS) Regulation 2014 states that the operator of an underground coal mine must provide fixed real time monitoring for the products of combustion in the general body of the air at -
- i. the conveyor drive head if determined by risk assessment
 - ii. the inbye side of each conveyor transfer but not greater than 30 metres
 - iii. the return side of each belt conveyor drive head
 - iv. conveyor drives with an installed power greater than 75kW
- n) AS/NZS1674.2 *Safety in welding and allied processes* nominates for a Category C environment the voltage between the electrode holder and workpiece while an arc is not present -
- i. shall not exceed 35 Vdc peak or 35 Vac peak and 25 Vac rms.
 - ii. shall not exceed 70 Vdc peak or 75 Vac peak and 48 Vac rms.
 - iii. shall exceed extra low voltage
 - iv. shall not exceed 113 Vdc peak or 68 Vac peak and 48 Vac rms.
- o) AS/NZS2760 *In service safety inspection and testing of electrical equipment* states the maximum tripping time for Type II RCDs shall not exceed -
- i. 40ms at 30mA
 - ii. 300ms at 30mA
 - iii. 150ms at 30mA
 - iv. 30ms at 30mA
- p) What minimum ingress protection (IP) rating would you nominate to protect against a solid object greater than 2.5 mm, such as a screwdriver -
- i. IPX2
 - ii. IP3X

- iii. IP2X
 - iv. IP4X
- q) Which best describes a Type 275 mining cable -
- i. heavy duty PCP sheath, semi conductive PCP cradle separator, central pilot conductor, EPR insulated and composite braid earth screened power conductors
 - ii. heavy duty PCP sheath, semi conductive PCP fill, central pilot, interstitial earth conductors, EPR insulated and semi conductive elastomer screened power conductors
 - iii. heavy duty PCP sheath, semi conductive PCP cradle separator, interstitial pilot conductors, EPR insulated and composite braid earth screened power conductors
 - iv. heavy duty PCP sheath, semi conductive PCP fill, central pilot conductor, interstitial earth conductors, EPR insulated power conductors
- r) The WHS Regulation 2017 states that a hazardous atmosphere exists if the concentration of flammable gas, vapour, mist or fumes -
- i. exceeds 25% of the LEL for the gas, vapour, mist or fumes
 - ii. exceeds 5% of the LEL for the gas, vapour, mist or fumes
 - iii. exceeds 1.25% of the LEL for the gas, vapour, mist or fumes
 - iv. exceeds 0.5% of the LEL for the gas, vapour, mist or fumes
- s) AS/NZS 3000 Wiring Rules states that installations operating at high voltage shall be installed in accordance with what standard -
- i. AS3008
 - ii. AS3007
 - iii. AS2067
 - iv. AS4871

- t) The certificate number for an item of explosion protected apparatus includes the suffix “U”. This would indicate -
- i. the item is a component part
 - ii. the item has specific voltage limitations
 - iii. the item has specific conditions of use
 - iv. the item certification has expired

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CM9 reference: DOC20/74977