higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

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NATIONAL CERTIFICATE: ENGINEERING CERTIFICATE OF COMPETENCY

SPECIALISED ELECTRICAL INSTALLATION CODES

(First Paper)

(8080644)

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This question paper consists of 8 pages and an information sheet of 3 pages.

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DEPARTMENT OF HIGHER EDUCATION AND TRAINING
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE: ENGINEERING CERTIFICATE OF COMPETENCY
SPECIALISED ELECTRICAL INSTALLATION CODES
(First Paper)
TIME: 3 HOURS
MARKS: 100

INSTRUCTIONS AND INFORMATION

1. Answer ALL the questions.
2. Read ALL the questions carefully.
3. Number the answers according to the numbering system used in this question paper.
4. Write neatly and legibly.

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QUESTION 1: GENERAL

1.1 Explain the difference between *explosion protected equipment* and *flame-proof equipment.* (2)

1.2 Medical locations may have hazardous conditions.

In which areas of medical installations will we find these locations, and what type of activities normally take place there? (2)

1.3 According to SANS 10142, Part 1:2012, medical locations are divided into different categories. These are group 0, 1, and 2 locations.

What connection, if any, exists between these and the area classification notations of zone 0, 1 and 2? (1)

1.4 The area classification marking CLASS 1 DIV 1A is found in existing installations.

Explain the meaning of this marking and give the current equivalent notification for area classification. (2)
[7]

QUESTION 2: OCCUPATIONAL HEALTH AND SAFETY ACT (ACT 85 OF 1993)

2.1 Which act of 1985 was incorporated into the OHS Act (Act 85 of 1993)?

2.2 With which government department does the jurisdiction of the OHS Act preside?

2.3 The chief inspector of Occupational Health and Safety is responsible for ensuring that all places of employment comply with the requirements in the act as far as a safe working environment is concerned. This includes underground mine activities as well.

Is this statement TRUE or FALSE?

2.4 What does the abbreviation GME which sometimes appear on explosion protected equipment represents?

2.5 Name ONE regulation incorporated in the OHS Act that form an integral part of specialised electrical installations.

(5 × 1) **[5]**

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QUESTION 3: SANS 10142 PART 1, 2008: THE WIRING OF PREMISES (LOW-VOLTAGE INSTALLATIONS)

CERTIFICATE OF COMPLIANCE (CoC)

3.1 If the signatures of two of the three parties (design, material procurement and construction) required do not appear on the inspection and test document, can a registered person still issue a certificate of compliance for the installation? Explain your answer. (2)

3.2 If maintenance is carried out on an electrical installation for which a certificate of compliance has been issued, does it render the certificate null and void? Explain your answer. (3)

3.3 Why does the inspection and test document make provision for a registered person to fill in the age of the electrical installation being inspected and tested? (3)

3.4 State the TWO additional inspection and test documents named in this standard. (2)

3.5 Additional certificate of compliance for a medical location:

3.5.1 Name the standard that previously dealt with the wiring requirements in medical locations. Reference to this standard is frequently still found in hospitals. Also state which standard has replaced the one referred to previously. (2)

3.5.2 Which TWO aspects related to the treatment of patients require special attention when evaluating a specialised electrical installation in a medical location? (1)

3 6 Additional certificate of compliance for hazardous locations:

3.6.1 A certificate of compliance can be issued for an electrical installation in potentially hazardous locations which have not been zoned (classified) yet.

Is this statement TRUE or FALSE?

3.6.2 Any change or alteration to the production process that influences the classification of the hazardous location does not affect the electrical certificate of compliance for the particular installation.

Is this statement TRUE or FALSE?

(2 × 1) (2)

[15]

QUESTION 4: SANS 60079 PART 17, 2009: INSPECTION AND MAINTENANCE OF ELECTRICAL INSTALLATIONS IN HAZARDOUS LOCATIONS

4.1 State the objectives of continuous supervision as per this standard. (3)

4.2 State FOUR tasks for which a technical person with executive functions appointed for an Ex installation, is responsible. (4)

4.3 State the requirements for exposed conductors of equipment that has been withdrawn/removed from service in an Ex installation. (4)

4.4 A risk-assessment approach for the acceptance of Ex equipment has been introduced as an alternative method to the current prescriptive and relative inflexible approach linking Ex equipment suitable for use in particular zones.

Define/Describe the following codes used to designate these equipment protection levels:

4.4.1 EPL Ga (gas group II) (2)

4.4.2 EPL Mb (gas group I) (3)

4.4.3 EPL Gb (gas group II) (2)

4.4.4 EPL Gc (gas group II) (2)

[20]

QUESTION 5: SANS 10089 – 2, 2007

The Petroleum Industry, Part 2: Electrical and other installations in the distribution and marketing sector.

5.1 Explain the difference between *flammable liquid* and *combustible liquid* as defined in this standard. (5)

5.2 This standard also refers to grade of release of flammable liquids, vapours and gasses.

Define the following subcategories of release:

5.2.1 Primary release

5.2.2 Secondary release

(3 × 2) (6)

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5.3 Static electricity is a high risk aspect in the petrochemical industry.

Explain how this could be controlled in the following circumstances:

5.3.1 Static electricity generated by filters and strainers (2)

5.3.2 Railway sidings used for bulk loading and off-loading of flammable substances (3)

5.3.3 Switch loading of class 1, class 2, and class 3 products (2)

5.3.4 The filling of small portable containers (3)

5.3.5 Hand operated drum pumps (2)

5.3.6 Containers used for transporting class I products (2)

[25]

QUESTION 6: SANS 10086 – PART 1 AND 2, 2013: THE INSTALLATION, INSPECTION AND MAINTENANCE OF EQUIPMENT USED IN EXPLOSIVE ATMOSPHERES

The installation, inspection and maintenance of equipment used in explosive atmospheres.

Part 1: Installations including surface installations on mines

6.1 Define the following terms as used in this standard:

6.1.1 Ignition temperature of a dust layer (2)

6.1.2 Ignition temperature of an explosive gas or vapour atmosphere (3)

6.1.3 Maximum surface temperature (3)

6.1.4 Extraneous conducive part (2)

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Part 2: Electrical equipment installed underground in mines

Increased safety (Ex e) motors

6.2 Ignition temperature of a dust layer

Complete the following extract from this standard by using the words in the list below. Write only the missing word or words next to the question number (6.2.1–6.2.6) in the ANSWER BOOK.

temperature; layer; indicators; outside; detectors; inside; circuit breaker; over-temperature tripping device; increase in speed; failure; null and void; acceptable

'Increased safety motors are not contained in a flame-proof enclosure. Consequently, any internal ignition of methane will result in an ignition of the gas outside the motor. In order to prevent this occurrence, the surface (6.2.1) … inside the motor shall be strictly controlled. This type of control can only be achieved by means of temperature (6.2.2) … mounted at various places (6.2.3) … the motor. The detectors shall feed an (6.2.4) … in the switch panel.'
'Disconnection or shorting out of these devices might induce premature (6.2.5) … and the possibility of explosions as previously described, but might also make the relevant test laboratory certificate for the motor or system (6.2.6) …' (6 × 1) (6)
[16]

QUESTION 7: SANS IEC 60079 PART 19, 1993: REPAIR AND OVERHAUL OF APPARATUS USED IN EXPLOSIVE ATMOSPHERES (OTHER THAN UNDERGROUND MINES AND EXPLOSIVE FACTORIES)

7.1 Explain the term *reclamation* used as a method to carry out repairs on explosion-protected electrical equipment. (3)

7.2 On some explosion-protected equipment the x-mark forms part of the markings on the equipment.

Explain what this mark means. (2)
[5]

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QUESTION 8: APPLICATION IS – LOOPS

The following information is available for equipment/components that form part of an IS loop circuit:

Ex FIELD DEVICE:
- A_{max}= 24 Vac
- I_{max} = 180 mA
- C_A= 0.03 µF
- L_i = 0.00 mH

BARRIER:
- V_{ac}= 28 Vac
- I_{sc}= 192 mA
- C_a= 0.13 µF
- L_a = 4.2 mH

These components are connected using a cable 200 metres long of a specific paired screened cable which has the following specifications from the manufacturer:

- A capacitance of 30 pF per metre
- Inductance is ignorable small

Calculate whether the parameters of the barrier and the field device will meet the requirements for an intrinsically safe system. Evaluate each parameter and indicate 'SUITABLE' or 'NOTSUITABLE'. **[7]**

TOTAL: 100

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INFORMATION SHEET

SANS 10142-1:2003
Edition 1.1

Table E.2(a) – Maximum lengths, in metres, of copper cables/circuits at a given circuit-breaker current rating for single phase (Fv = 2)

1	2	3	4	5	6	7	8	9	10
Nominal cross-sectional area mm²	Circuit-breaker current rating A								
	10	15	20	25	30	40	50	60	80
1	26	-	-	-	-	-	-	-	-
1,5	39	26	-	-	-	-	-	-	-
2,5	66	44	33	26	-	-	-	-	-
4	104	69	52	41	34	-	-	-	-
6	159	106	79	63	53	39	-	-	-
10	261	174	130	104	87	65	52	43	-
16	410	273	205	164	136	102	82	68	51

NOTE 1 Power factor is unity.
NOTE 2 Maximum permissible voltage drop between phases and neutral if full circuit-breaker loading is 5% of 230 V, i.e. 11,5 V.
NOTE 3 Only popular circuit-breaker ratings have been selected.

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INFORMATION SHEET

TABLE E.1 – Impedance of 600/1 000 V conductors that comply with SANS 1507

Ambient temperature: 30 °C
Conductor-operating temperature: 70 °C

1	2	3	4	5	6	7
Nominal cross-sectional area of conductor mm²	**Conductor resistance R for AC circuits** Ω/km		**Conductor reactance *X* for AC circuits** Ω/km		**Conductor resistance R for DC circuits** Ω/km	
	Material of conductor					
	Copper Cu	**Aluminium Al**	**Copper Cu**	**Aluminium Al**	**Copper Cu**	**Aluminium Al**
1	21,9	36,0	0,107	0,107	21,9	36,0
1,5	14,6	24,0	0,100	0,100	14,6	24,0
2,5	8,7	14,4	0,095	0,095	8,7	14,4
4	5,5	9,0	0,093	0,093	5,5	9,0
6	3,6	6,0	0,090	0,090	3,6	6,0
10	2,2	3,6	0,084	0,084	2,2	3,6
16	1,4	2,3	0,080	0,080	1,4	2,2
25	0,88	1,44	0,079	0,079	0,87	1,44
35	0,63	1,03	0,076	0,076	0,62	1,03
50	0,44	0,72	0,076	0,076	0,44	0,72
70	0,31	0,52	0,074	0,074	0,31	0,51
95	0,23	0,38	0,073	0,073	0,23	0,38
120	0,18	0,30	0,072	0,072	0,18	0,30
150	0,15	0,24	0,072	0,072	0,15	0,24
185	0,12	0,20	0,072	0,072	0,12	0,19
240	0,095	0,156	0,072	0,072	0,091	0,150
300	0,077	0,127	0,071	0,071	0,073	0,120
400	0,060	0,099	0,071	0,071	0,055	0,090
500	0,050	0,083	0,070	0,070	0,044	0,072
630	0,043	0,071	0,069	0,069	0,035	0,057
800	0,037	0,061	0,058	0,058	0,027	0,045
1 000	0,033	0,054	0,049	0,049	0,022	0,036

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INFORMATION SHEET

SANS 10142-1:2006 Edition 1.5 (As amended 2003 and 2006)

Table 6.4(b) – Multicore PVC isolated armoured cables (SANS 1507) Voltage drop (per ampere per metre) copper conductors

Conductor-operating temperature: 70 °C **Amdt 1**

1	2	3			4		
Conductor cross-sectional area mm²	**Two-core cable DC ‡ mV/A/m**	**Two-core cable, single-four-core phase AC ‡ mV/A/m**			**Three-core or four-core cable, three-phase AC mV/A/m**		
1	**2**	**3**			**4**		
1,5	29	29			25		
2,5	18	18			15		
4	11	11			9,5		
6	7,3	7,3			6,4		
10	4,4	4,4			3,8		
16	2,8	2,8			2,4		
		r	x	z	r	x	Z
25	1,75	1,75	0,170	1,75	1,50	0,145	1,50
35	1,25	1,25	0,165	1,25	1,10	0,145	1,10
50	0,93	0,93	0,165	0,94	0,80	0,140	0,81
70	0,63	0,63	0,160	0,65	0,55	0,140	0,57
95	0,46	0,47	0,155	0,50	0,41	0,135	0,43
120	0,36	0,38	0,155	0,41	0,33	0,135	0,35
150	0,29	0,30	0,155	0,34	0,26	0,130	0,29
185	0,23	0,25	0,150	0,29	0,21	0,130	0,25
240	0,180	0,190	0,150	0,24	0,165	0,130	0,21
300	0,105	0,155	0,145	0,21	0,135	0,130	0,185
400	0,145	0,115	0,145	0,185	0,100	0,125	0,160

‡ In the case of single-phase circuits, the return path has been accounted for in the values Given.

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