higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

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NON-NATIONAL CERTIFICATE: ENGINEERING CERTIFICATE OF COMPETENCY

INSTALLATION RULES

(Second Paper)

(11040432)

30 July 2018 (X-Paper)
09:00–12:00

This question paper consists of 7 pages and 3 pages of tables.

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DEPARTMENT OF HIGHER EDUCATION AND TRAINING
REPUBLIC OF SOUTH AFRICA

NON-NATIONAL CERTIFICATE: ENGINEERING CERTIFICATE OF COMPETENCY
INSTALLATION RULES
(Second 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. Even though NOT explicitly stated in a question, ALL answers must comply with the relevant codes and/or requirements of the SANS publications (latest edition) and the Occupational Health and Safety Act regulations.
5. The answers need NOT be word-perfect according to the publications in all aspects, but they must indicate that the candidate fully understands the context of the relevant question.
6. The necessary tables are supplied.
7. The candidate must pass PAPER 1 and PAPER 2 with 50% each. Both examination papers may be written during the same examination period. However, candidates need not pass both examinations during the same trimester, but the second examination must be passed within 12 months of the first otherwise both examinations must be re-written. If a candidate obtains 75 out of 100 marks in any ONE of the examinations, he/she will be permanently exempted from re-writing that examination. An appropriate statement will be issued. For accreditation purposes ALL candidates must meet the requirements prescribed by the Department of Labour.
8. NO condonations will be considered.
9. Candidates must attempt ALL the questions.
10. Start each question on a NEW page.
11. Write neatly and legibly.

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QUESTION 1: SANS 10142-1 OF 2008: INSTALLATION REQUIREMENTS-CURRENT CARRYING CAPACITY OF CONDUCTORS AND CABLES

Complete the following sentences by filling in the missing word(s). Write only the word(s) next to the question number (1.1.1–1.4) in the ANSWER BOOK.

1.1 The current carrying capacity of each conductor in a circuit that comes from a distribution board shall be the same at each point in the circuit, but only if the conductors of the lowest current-carrying capacity are protected against overcurrent in accordance with 6.2.1.1.

1.1.1 The current-carrying capacity of conducts at one or more points …

1.1.2 One or more spurs that have conductors of reduced …

1.1.3 At one point only, a circuit may be split into ...

(3 × 1) (3)

1.2 Except in the case of a ring circuit, there shall be no branches, tee-offs or socket-outlets along parallel conductors and, where two or more conductors are connected in parallel, the conductors shall …

1.2.1 Have the same … (2)

1.2.2 Follow the same … (1)

1.3 The current-carrying capacity of the circuit conductors for a motor shall … and possible increases in temperature owing to long or frequent starting must …

(2 × 1) (2)

1.4 In the case of a circuit that supplies two or more motors, the current-carrying capacity of the conductor shall … (2)

[10]

QUESTION 2: SANS 10142- OF 2008: INSTALLATION REQUIREMENTS MOTORS: CURRENT CARRYING CAPACITY OF CONDUCTORS AND CABLES

The sustained current-carrying capacity I(A) of a cable buried directly in the ground can be calculated using the following equation I = Is × F1 × F2 × F3 × F4 (A):

2.1 Explain the items on the equation.

2.1.1 F1

2.1.2 F2

2.1.3 F3

2.1.4 F4

(4 × 1) (4)

2.2 25 mm² × 4 and a 35 mm² × 4 core cable plus earth are installed and buried 0,9 meters underground, touching one another and the soil temperature is 35 ºC and the thermal resistance of the soil is 4 km/W.

Calculate the sustained current-carrying capacity of each cable. (6)
[10]

QUESTION 3: SANS 10142- 1 2008: INSTALLATION REQUIREMENTS MOTORS: CURRENT CARRYING CAPACITY OF CONDUCTORS AND CABLES

3.1 Give THREE materials from which an aerial conductor must be made of. (3)

3.2 Give SEVEN instances where PVC-insulated multi-core cables with a bare earthing and round cable with metal stiffening may be installed. (7)
[10]

QUESTION 4: SANS 10142 – 1 OF 2008: INSTALLATION REQUIREMENTS – DISTRIBUTION BOARD

Give FIVE requirements regarding the switch disconnectors for distribution boards.

(5 × 2) **[10]**

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QUESTION 5: SANS 10142 – 1 OF 2008: INSTALLATION REQUIREMENTS – FIXED APPLIANCES

5.1 Give the requirements regarding enclosure(s) for control components of fixed appliances that form part of the fixed installation, including their input terminations and associated protective switchgear that are not mounted in the distribution board. (5)

5.2 What are the requirements regarding the connection between circuit conductors and appliance conduction in fixed appliances? (2)

5.3 Give THREE positions for the disconnecting device for fixed appliances. (3)

[10]

QUESTION 6: SANS 10142 -1 0F 2008: INSTALLATION REQUIREMENTS – FIXED APPLIANCES

Indicate whether the following statements are TRUE or FALSE. Choose the answer and write only 'True' or 'False' next to the question number (6.1–6.10) in the ANSWER BOOK.

6.1 Fixed appliances do not form part of the electrical installation other than their position in relation to the supply and the wiring carried out between different parts of the appliances.

6.2 Where a fan or heater is included in a luminaire, the luminaire is not regarded as a fixed appliance.

6.3 If the luminaire circuit is protected by earth leakage a disconnector is not required.

6.4 In the case where a disconnector is built into the appliance a separate disconnecting device shall be provided in the fixed installation to allow for the total removal of the appliance.

6.5 A socket outlet may supply any number of appliances.

6.6 A dedicated circuit shall be provided for water heaters and there may be more than one water heater on each circuit.

6.7 A dedicated circuit(s) shall be provided for all cooking appliance(s) that are fixed and are rated at less than 16A.

6.8 The cables used to terminate underfloor heating shall be metal-sheathed, double-insulated or armored only.

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6.9 Accept in the case of a direct on line starting, a starter shall have an over voltage release that open the circuit if the supply voltage drops sufficiently to cause the motor to stop.

6.10 All accessible extraneous conductive parts associated with a water pump motor shall be bonded to the earth continuity conductor.

(10 × 1) **[10]**

QUESTION 7: SANS 10142 – 1 OF 2008: VERIFICATION AND CERTIFICATION

If during testing of prospective short-circuit current on a single-phase distribution board, a reading of 2,556 KA is obtained, explain the following:

7.1 How was the test performed, using 3 lead PSCC/loop tester? (2)

7.2 What will be the minimum KA rating of the main switch disconnector? Give a reason for your answer. (2)

7.3 What is the maximum current rating of the main switch disconnector for which this method of testing can be performed? (1)

7.4 Give FIVE alternative ways to obtain PSCC on three phase circuits. (5)
[10]

QUESTION 8: SANS 10142 – 1 0F 2008 – VERIFICATION AND CERTIFICATION

8.1 Give SEVEN electrical tests that can only be performed when the supply is on. (7)

8.2 Give TWO supplementary test reports that may be added to the test report for all electrical installations. (2)

8.3 What is the maximum resistance allowed when performing continuity of bonding tests? (1)
[10]

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QUESTION 9: SANS 10142–1 OF 2008: ANNEX L

Complete the following statements/sentences.

9.1 The distance across the SPDs including connection cables, from the live conductors to … (2)

9.2 The cross-sectional area of the bonding conductor:

9.2.1 For connection type 1 … (3)

9.2.2 For connection type 2 ... (4)

9.3 SPDs shall be installed after the point of control, where the point of control has … (1)

[10]

QUESTION 10: SANS 1973– 3 OF 2008: SAFETY OF ASSEMBLIES WITH A RATED PROSPECTIVE SHORT-CIRCUIT CURRENT OF UP TO AND INCLUDING 10KA

Give TEN inspections of the ASSEMBLY to be performed during routine tests. **[10]**

TOTAL: 100

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SANS 10142-1:2003
Edition 1.1

Table 6.13 — Correction factors for grouping of cables buried in the ground

1	2	3	4	5	6	7	8	9	10	11
Cable or pipe arrangement	Number of cables in group	Correction factors								
		Cables buried directly in the ground					Cables installed in pipes in the ground			
		Centre-line spacing mm								
		Touching	150	300	450	600	Touching	300	450	600
Horizontal spacing Spacing Drg.177wec	2	0,81	0,87	0,91	0,93	0,94	0,90	0,93	0,95	0,96
	3	0,70	0,78	0,84	0,87	0,90	0,82	0,87	0,90	0,93
	4	0,63	0,74	0,81	0,86	0,89	0,78	0,85	0,89	0,91
	5	0,59	0,70	0,78	0,83	0,87	0,75	0,82	0,87	0,90
	6	0,55	0,67	0,76	0,82	0,86	0,72	0,81	0,86	0,90
	7	0,52	0,65	0,75	0,81	0,86	0,70	0,80	0,86	0,89
	8	0,50	0,64	0,74	0,81	0,85	0,69	0,79	0,85	0,89
	9	0,48	0,63	0,74	0,80	0,85	0,68	0,78	0,84	0,88
	10	0,47	0,62	0,73	0,80	0,85	0,67	0,78	0,84	0,88
	11	0,45	0,61	0,72	0,80	0,84	0,66	0,77	0,84	0,88
Spacing Drg.177wec	12	0,44	0,60	0,72	0,79	0,84	0,65	0,77	0,83	0,87

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SANS 10142-1:2003
Edition 1.1

6.2.9.4 Groups of cables buried directly or installed in pipes buried in the ground

The number of cables, the grouping of the cables and the depth of the cables in the ground have a direct influence on the operating temperature of a cable (see tables 6.11, 6.12, 6.13 and 6.16).

Table 6.16 — Correction factors for depth of cables buried in the ground

SANS 10142-1:200
Edition 1.
(As amended 200

Table 6.8 *(concluded)*

1	2	3	4	5
Nominal conductor size mm²	**Standard rating[a] – Aluminium cables** A			
	Al	**Al**	**Al**	**Al**
25 35	106 128	90 108	86 104	73 87
50 70 95	151 188 225	129 158 192	123 153 184	104 130 157
120 150 185	– – –	219 245 278	– – –	179 201 229
240 300 400	– – –	324 366 –	– – –	268 304 –
NOTE See table 6.7(b) for voltage drop.				
[a] Standard conditions of installation: Depth of burial: 0,5 m Thermal resistivity of soil: 1,2 K·m/W Each cable is thermally independent.				

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Table 6.11 — Correction factors for soil temperature

Maximum conductor temperature: 70 °C

1	2
Soil temperature °C	**Correction factors for cables buried directly or buried in pipes in the ground**
10	1,15
15	1,11
20	1,05
25	1,00
30	0,94
35	0,88
40	0,82

Table 6.12 — Correction factors for thermal resistivity of soil

1	2	3
Thermal resistivity of soil K·m/W	**Correction factors**	
	Cables buried directly in the ground	**Cables installed in pipes buried in the ground**
0,7	1,17	1,07
0,8	1,13	1,05
0,9	1,09	1,04
1,0	1,06	1,02
1,2	1,00	1,00
1,5	0,93	0,96
2,0	0,83	0,91
2,5	0,76	0,87
3,0	0,71	0,83
3,5	0,65	0,8
4,0	0,61	0,77
NOTE The correction factors given have been averaged over the range of conductor sizes. Consult SANS 10198-4 if specific conductor size correction factors are required.		

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