higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NON-NATIONAL CERTIFICATE

INSTALLATION RULES

(Second paper)

(11040422)

21 November 2022 (X-paper)
09:00–12:00

Drawing instruments and nonprogrammable calculators may be used.

This question paper consists of 6 pages and 1 table.

110Q1E2221

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DEPARTMENT OF HIGHER EDUCATION AND TRAINING
REPUBLIC OF SOUTH AFRICA

NON-NATIONAL CERTIFICATE
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. The answers need not be word perfect according to the relevant publication/s in all aspects, but they must show that candidates fully understand the context of the relevant question.
5. Candidates must pass both Paper 1 and Paper 2 with 50% to be able to obtain a pass.
6. For accreditation purposes, all candidates must meet the requirements prescribed by the Department of Labour.
7. No condonations will be considered.
8. Necessary tables are supplied.
9. Start each question on a new page.
10. Write neatly and legibly.

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QUESTION 1: SANS 10142-1: INSTALLATION REQUIREMENTS: INSTALLATION OF CONDUCTORS AND CABLES

Complete the following sentences by filling in the missing word or words. Write only the word or words next to the question number (1.1–1.10) in the ANSWER BOOK.

1.1 A conductor shall be identifiable at its terminations unless …

1.2 Conductors shall be so insulated to withstand the highest temperature and voltage to which they are likely to …

1.3 The means of identification for an AC circuit may be …

1.4 The means of identification for a DC circuit may be …

1.5 An aerial conductor shall be of hard-drawn copper, stranded aluminium, or composite construction such as …

1.6 A surge arrester should be installed at each end of each aerial conductor circuit in …

1.7 A prefabricated wiring system that is not wired on site shall allow for variation in building dimensions in such a way that the system including cables, is not subjected to …

1.8 A prefabricated wiring system, especially any exposed cable ends, shall be protected against damage both during and …

1.9 Flexible cables shall only be joined using termination boxes, cable couplers or …

1.10 All joints shall be accessible, protected against strain, and protected in accordance with 5.2.1 except for joints made and scaled permanently and intended to be …

(10 × 1) **[10]**

QUESTION 2: SANS 10142-1: INSTALLATION REQUIREMENTS: CIRCUIT BREAKERS AND FUSES

Indicate whether the following statements are TRUE or FALSE. Choose the answer and write only 'True' or 'False' next to question number (2.1–2.10) in the ANSWER BOOK.

2.1 A circuit breaker that is used as main switch disconnector shall always have a switch disconnector positioned on its supply side.

2.2 A circuit breaker that is used as a switch shall comply with the requirements of standards for switches only.

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2.3 Except for a circuit breaker that is mounted next to the appliance or a socket outlet that it controls, each circuit breaker shall be labelled to show which circuit it controls.

2.4 Circuit breakers, disconnectors and switch disconnectors may be installed upside down if it fits in the enclosure.

2.5 Circuit breakers, disconnectors and switch disconnectors may be installed horizontally if it fits in the enclosure.

2.6 Reverse connection of circuit breakers is allowed if the manufacturer agrees.

2.7 Reverse connection is not allowed even if any contradictory marking is not visible after installation.

2.8 Where fuses are installed, they shall be installed in a distribution board and shall not be of the rewireable type.

2.9 There is no need to install a fuse in a distribution board if it is part of an appliance or a switch.

2.10 Fuse-protected circuits shall be marked with the maximum permissible current rating.

(10 × 1) **[10]**

QUESTION 3: SANS 10142-1: INSTALLATION REQUIREMENTS: CONSUMERS EARTH TERMINAL

Briefly explain how on would perform an installation with regard to the following:

3.1 Installation of the consumer's earth terminal (2)

3.2 Installation of earth fault detection and disconnecting devices (2)

3.3 Where one needs to connect conductors from different supplies to the main earthing terminal (4)

3.4 Installation of earthing terminal for other services (2)
[10]

QUESTION 4: SANS 10142-1: INSTALLATION REQUIREMENTS: SOCKET-OUTLETS

What are the requirements regarding the protective device of a protected socket outlet? **[10]**

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QUESTION 5: SANS 10142-1: INSTALLATION REQUIREMENTS: FIXED APPLIANCES

5.1 How would one supply power to fixed appliances? (2)

5.2 Give TWO methods to be used for connection of water heaters. (2)

5.3 How would one terminate a submersible water pump motor? (3)

5.4 Briefly explain requirements for an earth leakage protection to be used for a steam generator circuit. (3)

[10]

QUESTION 6: SANS 10142-1: VERIFICATION AND CERTIFICATION

As an installation electrician you are required to perform certain tests before electricity can be supplied to a new installation (230 volts, three-wire supply).

List each test and state the importance for performing such test/s. **[10]**

QUESTION 7: SANS 10142-1: VERIFICATION AND CERTIFICATION

7.1 A 120 cell battery unit supplies a DC. circuit for control purposes using 50 meters (NOTE: total length for circuit conductors) of 35 mm^2 copper conductors, the internal resistance of the whole battery unit is 1,08 Ω and the resistance on battery terminals is 1,06 Ω.

Calculate the PSCC of the batteries in Kilo Amperes. (8)

7.2 What must be taken into account when calculating the PSCC of a DC circuit? (1)

7.3 How else can one obtain the estimated PSCC of a battery? (1)

[10]

QUESTION 8: SANS 10142-1: ANNEX I: SURGE PROTECTIVE DEVICES INTO LOW-VOLTAGE SYSTEMS

Draw a labelled diagram of a TN-S supply system, showing connection type 2, for installation mode of SPDs. Do not include legends. **[10]**

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QUESTION 9: SANS 10142-1: ANNEXURE K: EARTHING ARRANGEMENTS AND EQUIPOTENTIAL BONDING OF I.T. INSTALLATION FOR FUNCTIONAL PURPOSES

9.1 Briefly state the scope for this Annexure. (3)

9.2 How must an earthing busbar be installed? (1)

9.3 Describe the purpose for each of the following with regard to functional earthing conductors.

9.3.1 Main earthing busbar (1)

9.3.2 Earth electrode (1)

9.3.3 Protective conductor (1)

9.3.4 Protective bonding conductor (1)

9.3.5 Earthing conductor (2)
[10]

QUESTION 10: SANS 1973-3: LOW-VOLTAGE SWITCHGEAR AND CONTROL GEAR ASSEMBLIES

10.1 Fully describe the scope for the above standard. (6)

10.2 Give FOUR routine tests and inspections that must be performed on each assembly above 125 A. (4)
[10]

TOTAL: 100

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Table D.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 a.c. circuits Ω/km		Conductor reactance *X* for a.c. circuits Ω/km		Conductor resistance *R* for d.c. 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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