higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NON-NATIONAL CERTIFICATE

INSTALLATION RULES
(Second paper)

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This marking guideline consists of 6 pages.

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QUESTION 1: SANS 1973-3: SAFETY OF ASSEMBLIES WITH A RATED PROSPECTIVE SHORT-CIRCUIT CURRENT OF UP TO AND INCLUDING 10 kA

1.1 True
1.2 True
1.3 False
1.4 False
1.5 True
1.6 True
1.7 False
1.8 False
1.9 True
1.10 True

(10 × 1) **[10]**

QUESTION 2: SANS 10142-1: INSTALLATION REQUIREMENTS: CURRENT-CARRYING CAPACITY OF CONDUCTORS AND CABLES

2.1
- Grouping and number of cables on racks or trays
- Grouping and number of cables in a trench
- Grouping and number of cables buried directly in the ground
- Grouping of cables installed in pipes buried in the ground (4)

2.2 Concentric and split concentric cables are single-phase XLPE insulated copper cables available in sizes 4 mm², 10 mm² and 16 m²✓ and are designed for aerial application, but may also be used underground.✓ These cables are primarily used for the provision of an electricity system from a distribution main or aerial bundled conductor's system to individual houses.✓

Split concentric cables are provided with an integral earthing conductor and can be used in single-phase circuits in an electrical installation.✓

Concentric cables only contain a phase and concentric conductor to be used in combined neutral earth systems✓ which does not make it suitable for circuits in an electrical installation except where a separate earthing conductor is installed.✓ (6)

[10]

QUESTION 3: SANS 10142-1: INSTALLATION REQUIREMENTS: PROTECTION

3.1
- If the supplier agrees
- If the supplier's protective device complies with Clause 4
- If the user has access to it
- If the protective device complies with the re-equipment of 6.7.2.1 (4)

3.2
- Along a conductor where the current capacity of the conductor is reduced.
- Where the thermal rating of a disconnecting device could be exceeded.
- Where the thermal rating of an earth-leakage protection device not provided with integral overcurrent protection, could be exceeded. (3)

3.3
- In a new installation for circuits that supply SANS 164-1 or 164-2 type socket outlets.
- In an existing installation for all the circuits that supply socket outlets when any such circuits are rewired or extended.
- In A.C. circuits supplying water heaters. (3)

[10]

QUESTION 4: SANS 10142-1: INSTALLATION REQUIREMENTS: EARTHING

4.1 To provide a connection to earth that:
- Is reliable and suitable for the protective and functional requirements of the installation.
- Can carry earth fault currents, protective conductor currents and leakage currents to earth without danger from thermal, thermomechanical and electromechanical stresses and from electric shock that arises from these currents.
- Also suitable for functional requirements. (3)

4.2
- All exposed conductive parts of an installation other than those described.
- All conductive cable sheaths and armouring, wireway and catenary wires.
- Earthing terminals of socket outlets.
- The secondary winding of a transformer if it is not a safety transformer.
- Earthing terminals of all permanently connected electrical equipment and appliances.
- Conductive parts of discharge luminaires and equipment that need special earthing arrangement.
- All Class 1 equipment. (7)

[10]

QUESTION 5: SANS 10142-1: INSTALLATION REQUIREMENTS: SOCKET OUTLETS

5.1
- Shall be of the two-pole and earthing contact type.
- Shall comply with SANS 164-0.
- For new electrical installations each socket-outlet point shall include at least one socket outlet complying with the dimensions of SANS 164-2.
- For power skirting or trunking systems, each SANS 164-1 socket outlet should be installed with at least one adjacent 164-2 socket outlet. (4)

5.2
- Be mounted that the floor can be cleaned or washed without the insulation resistance of the installation being affected.
- Be mounted that there is no risk of live parts touching any floor covering used. (2)

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5.3
- If it has earth-leakage protection
- If it is connected to a safety supply (2)

5.4
- SANS 164-2-1
- SANS 164-2-2 (2)

[10]

QUESTION 6: SANS 10142-1: VERIFICATION AND CERTIFICATION

6.1
- Conductors are of the correct rating and current-carrying capacity for the protective devices and connected load.
- Components have been correctly installed, and are accessible where necessary.
- Disconnecting devices are correctly located and that all switchgear switches phase conductors.
- Circuits, fuses, switching devices, terminals, earth leakage units, circuit breakers and distribution boards are correctly and permanently identified, marked or labelled. (4)

6.2 By checking values against Table 8.1✓ or by testing earth loop impedance at points of consumption.✓ (2)

6.3 From the distribution board to all exposed conductive points within arm's reach✓ or between exposed points themselves.✓ (2)

6.4 To ensure that all exposed points are connected to each other and to earth.✓✓ (2)

[10]

QUESTION 7: SANS 10142-1: VERIFICATION AND CERTIFICATION

7.1 Passes,✓ because maximum loop must be 1,917 Ω.✓

7.2 Fails,✓ because it must not exceed 25 V.✓

7.3 Passes,✓ because it must be between 15 and 30 m.a.✓

7.4 Fails,✓ it must not exceed 10 Ω.✓

7.5 Passes,✓ because it is less than 5% of the supplied voltage.✓

(5 × 2) **[10]**

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QUESTION 8: SANS 10142-1: VERIFICATION AND CERTIFICATION

8.1 PSCC = V/√3 × Z total

Z trs = (V² × Z%) ÷ (P × 10³ × 100)
= (400² × 0,048) ÷ (100 × 1000)
= 0,0768 Ω✓

Z cond. = L × √R² + X² ÷ 1000
= 65 × √0,31² + 0,074² ÷1000
= 0,021 Ω✓

Z total = Zt + Zc
= 0,0768 + 0,021✓
= 0,0978 Ω✓

Therefore: 400/√3 × 0,0978✓

= 2361.735 A✓ (6)

8.2 No,✓ because the main switch needs to be more sensitive than the load circuits that it feeds.✓ (2)

8.3 Helps to be able to choose the correct kA rating of circuit breakers to be installed in an installation.✓✓ (2)
[10]

QUESTION 9: SANS 10142-1: ANNEX D: CALCULATION OF VOLTAGE DROP

9.1 Pump: Vd = mv/a/m × A × M
= 11 × 10^{-3} × 13.04 × 22✓
= 3,156 V✓

Geyser: VD = mv/a/m × A × M
= 18 × 10^{-3} × 13.04 × 15✓
= 3,521 V✓

Heater: Red = mv/a/m × A × M
= 7,3 × 10^{-3} × 34,783 × 15✓
= 3,809 V✓

Total Vd = 3,156 + 3,521 + 3,809

= 10,486 V✓ (7)

9.2 It is acceptable, because it is less than 5% in total. (1)

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9.3 The higher the load given and the longer the cable means that the voltage drop is going to be more.✓✓ (2)
[10]

QUESTION 10: SANS 10142-1: ANNEX K: EARTHING ARRANGEMENTS AND EQUIPOTENTIAL BONDING OF I.T.

10.1
- Conductive screens, sheaths of armouring of telecommunication cables or telecommunication equipment.
- Earthing conductors for surge protective devices.
- Earthing conductors of radio communication antenna systems.
- The earthing conductor of an earthed D.C. power system for information technology equipment.
- Functional earthing conductors.
- Conductors of lighting protection systems. (6)

10.2
- Frequency range
- The prevailing electromagnetic environment
- Immunity or frequency characteristics of the equipment (3)

10.3 Material cost and impedance (1)
[10]

TOTAL: 100

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