higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE

INSTALLATION RULES
(Second Paper)

4 APRIL 2018

This marking guideline consists of 6 pages.

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QUESTION 1: SANS 1973–3 OF 2008: LV SWITCH GEAR AND CONTROL GEAR

1.1
- This part of SANS 1973 is applicable to low-voltage switchgear and controlgear assemblies that:
- Have a rated perspective short-circuit current of up to and including 10 kA
- Are stationary or movable
- Have a rated voltage not exceeding 1 000 V AC at a frequency not exceeding 50 Hz or 1 500 V DC
- Are intended for use in connection with the genuine transmission, distribution and conversion of electric energy and for the control of electric energy-consuming equipment
- Are designed for use under normal conditions but excluding use in explosive atmospheres where special requirements apply (Any 5 × 1) (5)

1.2 Pollution degree 1: No pollution or only dry, non-conductive pollution occurs.
Pollution degree 2: Normally only non-conductive pollution occurs; occasionally, however, a temporary conductivity caused by condensation can be expected.
Pollution degree 3: Conductive pollution or dry, non-conductive pollution occurs which becomes conductive due to condensation.
Pollution degree 4: The pollution generates persistent conductivity which is caused, for example, by conductive dust or by rain or snow. (5)
[10]

QUESTION 2: SANS 10142–1 OF 2008: ANNEX C: PSCC

2.1 Length of the cable in metres (2)

2.2 Conductor resistance in ohm/km (2)

2.3 Conductor reactance in ohm/km (2)

2.4 Open-circuit voltage of the battery (1)

2.5 Internal resistance of the battery (1)

2.6 Resistance of the battery connectors (1)

2.7 Resistance of the conductors (1)
[10]

QUESTION 3: SANS 10142–1 OF 2008: VOLTDROP

3.1 Given L = 50 m
R = ?
Motor current I = 10 000/230
= 43,47 A✓
Vd = Fv × I × R × L/1 000
Use 4 mm² cable = 50 A Vd = 2 × 43,47 × 5,5 × 50/1 000
= 23,91 V (Not acceptable, max to be 11,5 V) ✓✓
Use 6 mm² cable = 62 A Vd = 2 × 43,47 × 3.6 × 50/1000
= 15,65 V (Not acceptable, max to be 11,5 V) ✓✓
Use 10 mm² cable = 83 A Vd = 2 × 43,47 × 2,2 × 50/1 000
= 9,56 V ✓✓ (acceptable, less than 11,5 V) ✓✓
Therefore use 10 mm² cable. ✓ (8)

3.2 Because the voltage drop on 10 mm² is less than 5%. (1)

3.3 % Vd = 9,56/230 × 100 = 4,16% (1)
[10]

QUESTION 4: SANS 10142–1 of 2008: VERIFICATION AND CERTIFICATION

4.1 At various points of the outlet and for each phase conductor of the outlet,✓ pass an AC leakage current equal to the rated earth-leakage tripping current✓ through a resistance connected between a phase conductor and the earth continuity conductor.✓ The circuit is protected if the earth leakage unit trips.✓ Repeat the test with a leakage current at 50% of the rated earth-leakage tripping current;✓ the earth leakage unit shall not trip.✓ (6)

4.2
- By isolating and testing the wiring between the main supply and the sub-distribution board.
- By testing, as a separated section, each sub-distribution board connected to all the circuits that it feeds. (2 × 2) (4)

[10]

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QUESTION 5: SANS 10142–1 OF 2008

- Accessible components are correctly selected.
- All protective devices are of the correct rating and are capable of withstanding PSCC.
- Conductors are of the correct rating and current-carrying capacity for the protective devices and connected load.
- Components have been currently installed, and are accessible where necessary.
- Disconnecting devices are correctly located and all switchgear switches the phase conductor.
- Different circuits are separated electrically.
- The connections of conductors and earthing and bonding are mechanically sound and electrically continuous.
- Circuits, fuses, switches, terminals, earth leakage units, circuit-breakers, and distribution boards are correctly and permanently marked or labelled.
- Fire barriers have been erected and other precautions have been taken against the spread of fire or the effects thereof.
- Safety and emergency lighting and signs are functioning correctly
- Where an alternative supply is installed, it complies with the requirements in respect of connections, change-over switch and indicator.
- The position of the readily accessible earthing terminal for earth connections of other services by installers of such services is indicated on the distribution board.
- The installation, including all accessible components, complies with SANS 10142.
- The installation complies with the general safety principles of SANS 10142 and is reasonably safe. (Any 10 × 1) **[10]**

QUESTION 6: SANS 10142–1 0F 2008

6.1 True
6.2 False
6.3 True
6.4 True
6.5 True
6.6 False
6.7 True
6.8 False
6.9 False
6.10 True

(10 × 1) **[10]**

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QUESTION 7: SANS 10142–1 OF 2008: INSTALLATION OF CONDUCTORS

7.1
- Adversity after the current-carrying capacity, insulation resistance or earth continuity of the cable
- To be made in any connector, bend, elbow or tee piece of a conductor.
- Allow strands of a stranded conductor to spread.
- Require strands of a stranded conductor to be cut away to allow connection of the conductor. (4)

7.2
- Use only appropriate cleats, saddles and clamps.
- Cables shall be fixed in such a way as to prevent strain on terminals or connectors.
- A cable shall not be bent more than is recommended by the cable manufacturer.
- If a cable is not run on racks or pipes or ducts, it shall be firmly fixed to prevent sagging or creeping. (4)

7.3
- The backfill around them shall not contain sharp objects.
- There shall be a marker type that runs above the route of the cable, at a depth of between 0,3 m and 0,4 m. (2)

[10]

QUESTION 8: SANS 10142–1 0F 2008: WIREWAYS

8.1 safe maintenance is ensured

8.2 shall be at least as rigid as the wireway itself

8.3 shall protect the wiring at least as well as the rest of the wireway

8.4 shall be easily accessible even if they are above ceilings or below floorboards

8.5 shall have covers that prevent liquid from entering the wireway

8.6 the environmental conditions in which it is installed

8.7 be installed in the wireway, except in the case of 6.4.1(b).

8.8 shall be flattened, split or damaged

8.9 shall be separately earthed where any electrical equipment is fitted to such door covers or panels.

8.10 shall not be able to damage the insulation of cables installed

(10 × 1) **[10]**

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QUESTION 9: SANS 10142–1 of 2008: PROTECTION

9.1
- The supplier agrees.
- The supplier's protective device complies with clause 4.
- The user has access to the device.
- Such protective device complies with the requirement of 6.7.2.1. (4)

9.2
- The rated earth-leakage tripping current is higher than 30 mA.
- The socket outlet circuit is powered from safety supply.
- The socket outlet circuit is on a dimmer control. (3)

9.3
- Shall be protected by a fully rated short-circuit protective device.
- When used in combination with a short-circuit protection device, shall have a conditional short-circuit rating appropriate to its condition of installation, but of not less than 2,5 kA.
- The socket outlet circuit is on a dimmer control. (3)

[10]

QUESTION 10: SANS 10142–1 OF 2008: SOCKET OUTLETS

10.1
- Be of the two-pole plus earthing contact type.
- Comply with SANS 164-0.
- Have dimensions that comply with SANS 164-1 or SANS 164-2. (3)

10.2
- Have the voltage marked on them in a position that is visible after installation.✓
- Be of a plug and socket system such that the socket outlet cannot accept a plug in accordance with any part of SANS 164,✓ and the plug cannot be plugged into a socket in accordance with any part of SANS 164.✓
- In the case of SELV, comply with SANS 60906-3.✓ (4)

10.3
- Socket outlets rated at not more than 16 A and fixed luminaires
- Socket outlets and fixed appliances
- Socket outlets, luminaires and fixed appliances (3)

[10]

TOTAL: 100

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