higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE

INSTALLATION RULES
(Second Paper)

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This marking guideline consists of 6 pages.

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QUESTION 1: SANS 10142-1 OF 2017: CURRENT-CARRYING CAPACITY OF CONDUCTORS AND CABLES

- Cables in conduit
- Cables in building voids
- Cables in trunking
- Cables open and clipped directly
- Cables embedded directly in building material
- Cables on trays
- Cables in free air on cleats, brackets or a ladder
- Cables in trenches
- Cables buried in the ground **[10]**

QUESTION 2: SANS 10142-1 OF 2017: DISTRIBUTION BOARDS

- The mechanical and electrical integrity of the distribution board shall not be infringed.
- The integrity of the area in a distribution board or a section of a distribution board that comprises the conductors between the main busbars and the supply side of functional units and the components included in these units, which is regarded as fault-free on the basis of the reduced short-circuit stresses that occur on the load side of the prospective short-circuit protective device in each unit, is still applicable.
- Extensions to the busbar systems shall not adversely affect the electrical and mechanical performance of the complete busbar system.
- Components shall be selected for their suitability for application taking into account information available from the component manufacturers. It might be necessary to derate the components depending upon environment and application conditions.
- Any changed properties due to alteration or extension of the distribution board shall be marked indelibly on a supplementary nameplate.
- The required IP rating shall not be reduced. **[10]**

QUESTION 3: SANS 10142-1 OF 2017: PROTECTION

3.1 It is a protection system✓ that allows for the installation of circuit breakers which cannot necessarily be rated to handle the full prospective short-circuit current at their points of installation,✓ provided that they are backed up by another fully rated circuit breaker in a predetermined and tested coordination.✓ (3)

3.2 Except when recommended by the circuit-breaker manufacturer, do not replace any circuit breaker in the system with a circuit breaker that is not of identical type and rating. (2)

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3.3
- In new installations for circuits that supply SANS 164-1 or SANS 164-2 type socket outlets
- In an existing installation for all circuits that supply socket outlets when any such circuit or circuits are rewired or extended
- In circuits that supply electrode water heaters (geyser) (3)

3.4 3.4.1 Both phase and neutral
3.4.2 All three phases
(2 × 1) (2)
[10]

QUESTION 4: SANS 10142-1 OF 2017: CIRCUIT BREAKERS, DISCONNECTING DEVICES AND FUSES

4.1
- Specifically allowed by the manufacturer
- Load and Line marked to be clearly visible during maintenance
- Any contradictory marking not visible after installation (3)

4.2
- Within arm's reach from the terminals of the appliance
- In a distribution board, if the device is capable of being locked in the open position (2)

4.3 4.3.1 False
4.3.2 True
4.3.3 True
4.3.4 False
4.3.5 False
(5 × 1) (5)
[10]

QUESTION 5: SANS 10142-1 OF 2017: FIXED APPLIANCES

5.1
- In the same room as the appliance(s)
- At a height above floor level of not less than 0,5 m and not more than 2,2 m
- Preferably not be above the cooking appliance(s)
- Within 3 m of the appliance(s), but within 0,5 m of the appliance(s) if the switch disconnector's purpose is not clearly indicated
- Not be fixed to the appliance (5)

5.2
- Metal sheathed
- Double insulated
- Cables with reinforced insulation (3)

5.3 All accessible extraneous conductive parts associated with a water-pump motor shall be bonded to the earth-continuity conductor. (2)
[10]

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QUESTION 6: SANS 10142-1 OF 2017: VERIFICATION AND CERTIFICATION

6.1 Test between each phase, neutral and earth and record the highest reading (2)

6.2 $Z = V/2 \times I$
$= 400\ V/(2 \times 80\ A) = 2{,}5\ \Omega$ (2)

6.3 To ensure a low impedance reading of the earth conductor so that the main protective device automatically disconnects the supply to the installation when an earth fault current of twice or more the rated current flows (2)

6.4 No, there is no neutral conductor in an IT system. (2)

6.5 Yes, it is less than the rated 6 kA of the main switch. (2)
[10]

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

7.1
- Continuity of bonding
- Resistance of earth-continuity conductor
- Continuity of ring circuits
- Polarity at point of consumption (Any 3 × 1) (3)

7.2
- Elevated voltage on supply neutral
- Voltage, main distribution board – no load
- Voltage, main distribution board – on load
- Voltage at available load
- Polarity at point of consumption (Any 4 × 1) (4)

7.3
- Earth-leakage test button
- Switching devices (2)

7.4 No (1)
[10]

QUESTION 8: SANS 10142-1 OF 2017: ANNEXURE D: CALCULATION OF VOLTAGE DROP

8.1 For 15 A use 1,5 mm²
Vd = *m*v/am × I × L
= 29/1 000 × 15 × 20
= 8,7 V✓✓
Therefore 1,5 mm² is suitable because the voltage drop is less than 5%✓ (3)

8.2 P = V × I × 1,732
= 10 000/692,8
= 14,43 A✓

use 1,5 mm² cable
Vd = *m*v/Am × I × L
= 25/1 000 × 14,43 × 10
= 3,6 V✓
Therefore 1,5 mm² is suitable because the voltage drop is less than 5%✓ (3)

8.3 L = Vd/(*m*V/A/m × I)
= 20 V (max Vd on 400 V)/ [(2,4/1 000) × 80]
= 104,16 m✓✓✓ (3)

8.4 Available current in red phase for circuit C:
C = 80 A – 14,43 A – 15 A
= 50,57 A✓ (1)
[10]

QUESTION 9: SANS 10142 OF 2017: ANNEXURE I: INSTALLATION OF SURGE PROTECTION DEVICES (SPDS) INTO LOW-VOLTAGE SYSTEMS

1. The bonding bridge on SPDs
2. The distance across the SPDs, including connections, cables and the SPDs, from the live conductors to the consumer's earth terminal (E)
3. The bonding conductor between the SPD bonding bridge and the consumer's earth terminal (E) for connection type 1✓ or between the SPD from neutral earth and the consumer's earth terminal (E) for connection type 2✓
4. The designated area indicates a single-phase installation
5. SPDs installed after the point of control
6. Connection type 1
7. The distance (a) to (b) between the PEN connection at the point of control and the consumer's earth terminal (E)
8. Overcurrent protective device (see I.1.5)
9. SPDs between live and neutral in series **[10]**

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

10.1	shrouded by nonflammable material	(1)
10.2	protected against corrosion	(1)
10.3	rodent proof	(1)
10.4	have a degree of protection with a rating of IP2X	(1)
10.5	rely on the door or panel(s) to ensure rigidity	(1)
10.6	in accordance with the manufacturer's instruction	(1)
10.7	alter the position of components	(1)
10.8	it can cause injury when operated	(1)
10.9	certified by a person who is competent to express an opinion on the safety of the assembly	(2)
		[10]

TOTAL: 100

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