higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE

INSTALLATION RULES
(Second paper)

9 APRIL 2021

This marking guideline consists of 7 pages.

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QUESTION 1: SANS 10142-1 OF 2017: INSTALLATION REQUIREMENTS: GENERAL CIRCUIT ARRANGEMENTS

1.1
- Circuit is protected by multipole circuit-breaker or single-phase protective devices with multipole switch-disconnector on supply side.
- Throughout circuit, neutral conductor has same nominal cross-sectional area as associated phase conductors.
- Tee-joints are accessible✓ and main neutral conductor remains unbroken when tee-joints are removed.✓
- The total load is, as nearly as is practicable, balanced over the three phases. (5)

1.2
- Required by relevant product solely for termination or connection of moving parts.
- Specified in product standard.
- Used as single cores in conduits.
- Used in authorised wiring system.
- Needed for connection of luminaires, provided that each connection is limited to one luminaire and not longer than 3 m. (5)

[10]

QUESTION 2: SANS 10142-1 OF 2017: INSTALLATION REQUIREMENTS: INSTALLATION OF CONDUCTORS AND CABLES

2.1
- Neutral shall be identified by black only.
- Earth continuity conductor shall be identified by bi-colour green/yellow only, or by being bare.
- Phase conductor shall be identified by colour other than green/yellow, green or black.
- Where numbers are used, 'O' shall indicate neutral conductor. (4)

2.2
- All equipotential bonding, earth continuity and protective earthing conductors shall be bi-colour green/yellow only or
- shall be bare.
- Where colours are used polarity of positive conductor shall be identified by red only.
- Negative conductor by black or blue.
- Where symbols are used polarity of positive conductor shall be identified by + symbol.
- Polarity of negative conductor shall be identified by – symbol. (6)

[10]

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QUESTION 3: SANS 10142-1 OF 2017: INSTALLATION REQUIREMENTS: EARTHING

3.1 True
3.2 True
3.3 True
3.4 False
3.5 False
3.6 False
3.7 True
3.8 True
3.9 False
3.10 False

(10 × 1) **[10]**

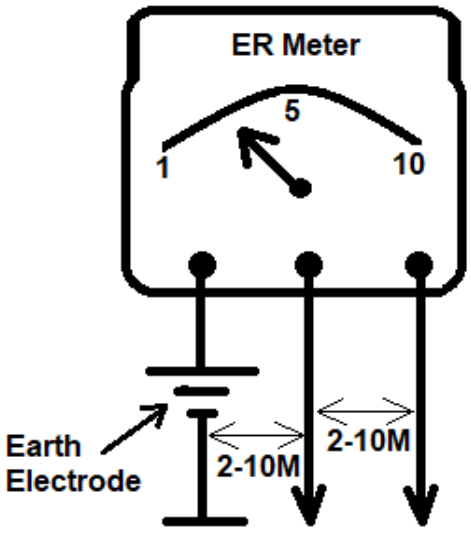
QUESTION 4: SANS 10142-1 OF 2017: INSTALLATION REQUIREMENTS: CURRENT-CARRYING CAPACITY OF CONDUCTORS AND CABLES

4.1 Is – Standard rating of the cable in amperes.
F1 – Rating factor for depth of burial.
F2 – Rating factor for soil temperature at depth of burial.
F3 – Rating factor for thermal resistivity of soil.
F4 – Rating factor for grouping of directly buried cables. (5)

4.2 I = Is × F1 × F2 × F3 × F4 ….Ampere✓
= 70 × 0.96 × 0.88 × 0.76 × 0.74✓✓
= 33.25 A✓✓ (5)
[10]

QUESTION 5: SANS 10142-1 OF 2017: VERIFICATION AND CERTIFICATION: TESTING

5.1



- Insert test spikes into soil as shown on diagram.
- Ensure that meter leads are not twisted and spikes are in straight line.
- First measure earth voltage and if correct, measure earth resistance. (6)

5.2 Calculate the value by using the formula: Re max = V line/2xmain CB value. (1)

5.3 Test spikes can be wet with water and test repeated. (2)

5.4 Cover test spikes with wet rags, add salt to water if needed. (1)
[10]

QUESTION 6: SANS 10142-1 OF 2017: VERIFICATIONN AND CERTIFICATION: TESTING

6.1 Switch on maximum available load and measure voltage at point of control. Notify supplier if voltage is outside regulatory limits. (2)

6.2
- Select circuit and point of consumption where worst voltage drop condition is expected.
- Switch on maximum available load, but at least 5 % of circuit load but not less than 2 A.
- Measure voltage at that point of consumption. Record value.
- Voltage drop from point of supply to point of consumption shall not exceed 5 %. (4)

6.3 Ensure that:
- All single-pole switching devices, fuses and circuit-breakers have been connected in the phase conductor.
- Phase terminals in fixed appliances and in all single-phase socket-outlets have been connected to phase conductor.
- Centre contact of each Edison-screw lamp holder is connected to phase conductor.
- Phase rotation and identification is maintained for three-phase systems on supply sides of all distribution boards. (4)
[10]

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QUESTION 7: SANS 10142-1 OF 2017: VERIFICATIONN & CERTIFICATION: TESTING

7.1 $P_{SCC} = V/ \sqrt{3} \times Zt$

$Z_{trs} = V^2/P \times 3\ Z\%/100$
$= (400^2/100 \times 10^3) \times (4.8/100)$
$= 0.0768\ \Omega$✓✓

$Z_{cond} = [L\sqrt{(R^2 + X^2)}] \div 1000$
$= 50\sqrt{(0.32^2 + 0.074^2)}] \div 1000$
$= 0.0158\ \Omega$✓✓

$Z_{total} = Z_{trs} + Z_{cond}$
$= 0.0768 + 0.0158$
$= 0.093\ \Omega$✓✓

$P_{SCC} = 400/\sqrt{(3 \times 0.093)}$
$= 2.483$ kA =✓✓ (8)

7.2 7.2.1 Eb – Open circuit voltage of batteries

7.2.2 Rbbr – Total resistance of network

(2 × 1) (2)
[10]

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

8.1 Pump 3000 W/230 V = 13 A✓

$V_d = 2 \times \rho \times L \times I/Area$

$L = (V_d \times Area)/ 2 \times \rho \times I$

$= (7.7 \times 4)/(2 \times 0.022 \times 13)$✓

= +/- 53 meters✓ (3)

8.2 I_{geyser} = 4000 W/23 V

= 17.4 A✓

$V_d = 2 \times \rho L \times I$

$= 2 \times 0.0223 \times 10 \times 17.4$✓

= 3.10 V✓ (3)

8.3 V_d @ D_B = 7.7 + 3.10
= 10.8 V✓✓ (2)

8.4 Acceptable✓ because it is less than 5%.✓ (2)
[10]

QUESTION 9: SANS 10142-1 OF 2017: ANNEX L: CLASSIFICATION OF SAFETY SERVICES NECESSARY FOR MEDICAL LOCATION

9.1 Room in which diagnostic or therapeutic procedures are performed on the urogenital tract when medical electrical equipment is used, such as X-ray equipment, endoscopic equipment and high-frequency surgery equipment. (2)

9.2 Room intended for the use of ionizing radiation for the display of internal structures of the body by means of radiography or fluoroscopy, or for the use of radioactive isotopes, or for other diagnostic purposes. (2)

9.3 Room in which general inhalation anaesthetics (gas) are intended to be administered. (1)

9.4 Room in which plaster of Paris or similar dressings are applied while anaesthesia is maintained. (1)

9.5 Room in which the patient under observation recovers from the influence of anaesthesia. (1)

9.6 Room intended for the examination of the heart using catheters. Examples of applied procedures are measurement of action potentials of the haemodynamic of the heart, drawing of blood samples, injection of contrast agents, or application of stimulants. (2)

9.7 Room in which bed patients are monitored independently of an operation by means of medical electrical equipment. Body actions may be stimulated if required. (1)
[10]

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

10.1	Complies with the isolating requirements specified for a disconnector.	(1)
10.2	Ensure electrical continuity of below 0,1 Ω.	(1)
10.3	Be connected to the protective earth conductor✓ by a flexible conductor of cross-sectional area at least 4 mm².✓	(2)
10.4	No electrical components fitted to them.	(1)
10.5	Creepage distance between phases and between each phase✓ and earth shall be 16 mm².✓	(2)
10.6	Clearance distance between phases✓ and between phase and earth shall be 8 mm.✓	(2)
10.7	Verified in accordance with 5.2.	(1)
		[10]

TOTAL: 100

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