higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NON-NATIONAL CERTIFICATE

INSTALLATION RULES
(Second paper)

21 November 2022

This marking guideline consists of 7 pages.

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QUESTION 1

1.1 its purpose is obvious
1.2 be exposed
1.3 by colours or by numbers
1.4 by colours or by symbols
1.5 steel-cored aluminium
1.6 an installation
1.7 any strains
1.8 after installation
1.9 manufacturers jointing kits
1.10 maintenance free

(10 × 1) **[10]**

QUESTION 2

2.1 False
2.2 False
2.3 True
2.4 False
2.5 True
2.6 True
2.7 False
2.8 True
2.9 True
2.10 True

(10 × 1) **[10]**

QUESTION 3

3.1 Be earthed by connecting it to the supply earth terminal or the protective conductor✓ and if installed, the earth electrode✓ (2)

3.2 That it operates at a current related to the earth loop impedance which will limit prospective touch voltages✓ under short-circuit fault conditions to 25 V for a period not exceeding 5 s.✓ (2)

3.3 Each conductor connected to the main earthing terminal shall be able to be disconnected individually without having to disturb any of the other earthing conductors,✓ irrespective of the number of supplies.✓ All connections shall be disconnectable only by means of a tool,✓ shall be mechanically sound, and shall ensure the maintenance of electrical continuity.✓ (4)

3.4 Where installed, such an earthing terminal shall be bonded to the consumers earth terminal by a conductor of at least 6 mm² copper or equivalent✓ and shall be identified by the earth symbol.✓ (2)

[10]

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QUESTION 4

- Shall have a fixed rated current that does not exceed the rating of the socket outlet✓
- Shall be mounted next to the socket outlet that it protects✓
- Shall provide protection against overload currents✓
- Shall provide protection against short circuit currents,✓ unless short circuit protection is provided by a separate device, for example on the distribution board✓
- Shall, if it needs the protection of a back-up short-circuit device,✓ be marked with the required or maximum rating of the back-up device✓
- Shall, if it protects more than one socket outlet, be so installed that all the socket outlets are connected in parallel,✓ have the same rated current, and are mounted next to the device✓
- If it is a circuit breaker, comply with the requirements of 6.8.2✓ **[10]**

QUESTION 5: FIXED APPLIANCES

5.1
- Use a disconnecting device that disconnects both live conductors in a single-phase supply and all phases in a multiphase supply
- Use a socket outlet that is directly accessible at all times that any person is exposed to such appliance while the supply is on (2)

5.2
- Water heater shall be bonded and connected through an earth leakage protection device
- Dedicated circuit shall be provided and there may be more than one on each circuit (2)

5.3
- Use a suitable marine type flexible cable firmly attached to the motor
- Use a cable gland that has an efficient water seal
- Bond the pump to the earthing system of the installation (3)

5.4
- It shall be set to operate in the event of a leakage current exceeding 10% of the current consumed by the appliance under normal conditions of operation✓
- The characteristics of the circuit and of the earth return path shall be such that the earth leakage device will operate✓ before the potential between earth and shell steam generator exceeds 50 V, including under short-circuit fault conditions✓ (3)

[10]

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QUESTION 6: VERIFICATION AND CERTIFICATION

- Continuity of bonding✓ – to ensure that cold and hot water copper and metal pipes are connected to consumer's earth terminal✓
- Resistance of the earth continuity conductor✓– to ensure that all earthing terminals of all points of consumption and switches are connected to the consumer's earth terminal✓
- Continuity of ring circuits✓– to ensure that if there are any ring circuits, they are marked and identified as such✓
- Insulation resistance✓ – to ensure that there is no short-circuit or high impedance faults in the installation✓
- Polarity at point of consumption✓ – to ensure that live and neutral conductors are not reversed anywhere in the installation✓
- Switching devices✓ – to ensure that when switching devices are operated, the circuit is interrupted as intended✓ (Any 5 × 2) **[10]**

QUESTION 7

7.1 $E_B = 1{,}05 \times U_{NB}$ V
$= 1{,}05 \times 2{,}0 \times 120$✓
$= 252$ V✓

$R_Y = 0{,}62 \times 0{,}05$✓
$= 0{,}031\ \Omega$✓
$R_{BBR} = 0{,}9 \times R_B \times R_{BL} \times R_Y\ \Omega$
$= 0{,}9 \times 1{,}08 \times 1{,}06 \times 0{,}031$ ✓
$= 0{,}032\ \Omega$✓

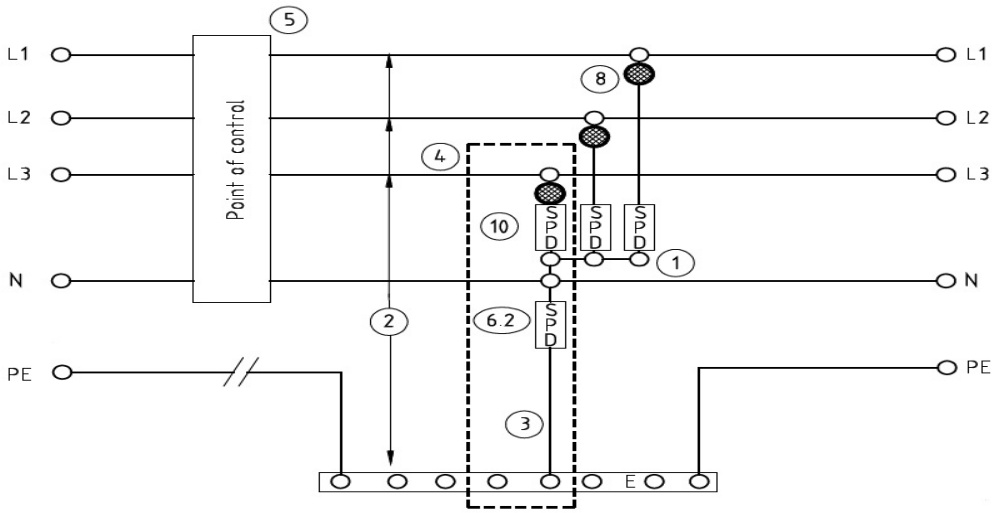
$PSCC = E_B \div R_{BBr}$
$= 252 \div 0{,}032$✓
$= 7875$ A
$= 7{,}875$ KA✓ (8)

7.2 Take all sources into account (1)

7.3 From the manufacturer of the battery (1)
[10]

QUESTION 8

Installation mode of SPDs – Connection Type 2 for TN-S supply system



[10]

QUESTION 9

9.1 Provides functional provisions for earthing and equipotential bonding for information technology installations and similar equipment that require interconnectors for data transmission purposes and other electronic equipment that is susceptible to interference. (3)

9.2 It shall be installed so that it is accessible throughout its length. (1)

9.3 9.3.1 Enables the electric connection of a number of conductors for earthing purposes (1)

9.3.2 For lighting protection system (1)

9.3.3 For purpose of safety (1)

9.3.4 For protective equipotential bonding (1)

9.3.5 Provides a conductive path, or part of the conductive path,✓ between a given point in a system or in an installation or in equipment and an earth electrode✓ (2)

[10]

QUESTION 10

10.1 Is applicable to low-voltage switchgear and control gear ASSEMBLIES that:✓
Have a rated prospective 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 frequencies not 50 Hz, or 1 500 V DC✓
Are intended for use in connection with the generation, 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 the use in explosive atmospheres where special requirements apply✓ (6)

10.2
- Inspection of the wiring and an electrical operation test
- The dielectric test
- The checking of protective measures
- The insulation resistance test (4)

[10]

TOTAL: 100

SUBJECT:	INSTALLATION RULES PAPER 2						QUESTION PAPER NUMBER:						NS 02 OF 2020
NQF LEVEL:							SETTING CYCLE:						2020
Topic(s)	SOs/ACs/Learning Outcome(s)	Question/Item Number	Format/Type (SR/MR/ER)	Max. score Allocation	± Time Allocation (Min.)	Alternative Answers Possible Y/N	Level of Demand			Cognitive Category			Total
							L	M	H	K	C	A	
SANS 10142-1	Installation of conductors and cables	1	SR	10	10	NO	10			10			10
SANS 10142-1	Circuit breakers and fuses	2	SR	10	10	NO	10			10			10
SANS 10142-1	Consumers earth terminal	3	FR	10	15	NO		10				10	10
SANS 10142-1	Socket-Outlets	4	MR	10	15	NO		10				10	10
SANS 10142-1	Fixed appliances	5	FR	10	15	NO		10				10	10
SANS 10421-1	Verification and certification	6	MR	10	15	NO			10			10	10
SANS 10142-1	Verification and certification	7.1	FR	8	15	NO			8			8	8
		7.2 & 7.3	SR	2	5	NO	2			2			2
SANS 10142-1	ANNEX I	8	MR	10	20	NO		10			10		10
SANS 10142-1	ANNEX K	9	MR	10	15	NO		10			10		10
SANS 1973-3	Low-voltage switchgear and control ASSEMBLIES	10	MR	10	15	NO		10			10		10
TOTALS:				100	150		22	60	18	22	30	48	100

SR = Short Response	L = Low Level of Demand	K = Knowledge (Remembering/ Understanding)
MR = Moderate Response	M = Moderate Level of Demand	C = Comprehension (Applying/ Analysing)
FR = Free Response	H = High Level of Demand	A = Analysis (Evaluating/ Creating)

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