



**higher education
& training**

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE

ELECTRICAL TRADE THEORY N2

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This marking guideline consists of 6 pages.

QUESTION 1: CONDUCTORS AND CABLES

- 1.1
- The price of energy increases with a low power factor
 - Conductor or cable sizes may have to increase with a low power factor
- (2 × 1) (2)
- 1.2
- $$\begin{aligned} \text{IFC} &= \frac{\text{CIF} \times A}{\sqrt{t}} \\ &= \frac{62 \times 20}{2} \checkmark \checkmark \\ &= 620 \text{ A} \checkmark \end{aligned}$$
- (3)
- 1.3
- 1.3.1 Q
- 1.3.2 VAr (Volt Amperes Reactive)
- 1.3.3 I
- 1.3.4 A (Amperes)
- 1.3.5 S
- 1.3.6 VA (Volt Ampere)
- (6 × 1) (6)
- [11]**

QUESTION 2: SWITCHGEAR, CONTACTORS AND RELAYS

- 2.1 The time taken for the bi – metal strip✓ to heat and bend far enough ✓ to activate the tripping mechanism✓. The larger the overload current, the shorter the time delay. ✓
- (4)
- 2.2
- Crimped ferrule joint
 - Britannia joint
 - Scarf joint
 - Married joint
 - Line taps
 - Screw connectors
 - Strip connectors
- (Any 4 × 1) (4)
- 2.3
- Relay
 - Contactors
- (2 × 1) (2)
- 2.4
- To avoid tampering that will affect the miniature circuit breaker rating.
 - To validate the guarantee
- (2 × 1) (2)
- [12]**

QUESTION 3: DC MOTORS AND STARTERS

- | | | | |
|-----|---|---|-------------|
| 3.1 | 3.1.1 | The spring loaded arm during start – up switches out starting resistors as the motor speeds up | (1) |
| | 3.1.2 | The NVR (no voltage relay) will release the spring loaded arm if the voltage across it drops. | (1) |
| | 3.1.3 | The contacts of the overload – coil will open and disconnect the NVR.✓ This will release the spring loaded arm and stop the motor.✓ | (2) |
| 3.2 | 3.2.1 | False | |
| | 3.2.2 | False | |
| | 3.2.3 | False | |
| | 3.2.4 | False | |
| | | (4 × 1) | (4) |
| 3.3 | 3.3.1 | The series and shunt field coils are connected in such a way that the Amp – turns of the two coils assist each other. | |
| | 3.3.2 | The series and shunt field coils are connected in such a way that the Amp – turns of the two coils oppose each other. | |
| | | (2 × 1) | (2) |
| 3.4 | The speed increases✓ exponentially to dangerous levels✓ | | (2) |
| | | | [12] |

QUESTION 4: AC MOTORS AND STARTERS

- | | | |
|-----|----------------------|-----------------|
| 4.1 | Stator✓ and rotor✓ | (2) |
| 4.2 | Megger
Multimeter | (Any 1 × 1) (1) |

4.3 Short-circuit and open-circuit tests✓

A low reading for one coil will indicate a short circuit of some or all of the turns. A slightly higher reading will indicate a loose connection and a high reading could indicate an open circuit with a carbon. ✓

Insulation resistance to earth test ✓

- The reading will be high, usually above 500 000 ohms and must be at least as high as that recommended by the Manufacturer. ✓

Insulation resistance test between windings✓

The readings will be high, usually above 500 000 ohms and must be at least as high as that recommended by the manufacturer✓

(6)

- 4.4
- | | |
|-------|--------------------------|
| 4.4.1 | Easily/ Quickly/ Cheaply |
| 4.4.2 | Quickly/ Easily/ Cheaply |
| 4.4.3 | Cheaply/ Quickly/ Easily |
| 4.4.4 | Switching |
| 4.4.5 | Supply |
| 4.4.6 | Small |

(6 × 1)

(6)

[15]**QUESTION 5: EARTHING**

- 5.1
- | | |
|-------|-----------------------|
| 5.1.1 | The earth conductor |
| 5.1.2 | The neutral conductor |

(2 × 1)

(2)

- 5.2 Earthing is effected for overhead lines by installing a bare earth conductor above the overhead lines. ✓ This conductor is then grounded. ✓

(2)

- 5.3 It is a conductor provided for the purposes of safety (protection against electric shock) ✓ and that also connects the supply earth to the consumers' earth terminal. ✓

(2)

- 5.4 To connect the earth continuity conductor✓ to the cable armouring or steel enclosure. ✓

(2)

- 5.5
- | | |
|-------|---|
| 5.5.1 | The earth continuity conductor connections ✓should be tamper-proof. ✓ |
|-------|---|

- | | |
|-------|---|
| 5.5.2 | The fault current should not cause excessive heating ✓of the earth-continuity conductors. ✓ |
|-------|---|

(2 × 2)

(4)

[12]

QUESTION 6: PROTECTION

- | | | | | |
|-----|-------|---|---------|-------------|
| 6.1 | 6.1.1 | Reset that is done by hand. | | |
| | 6.1.2 | The rapid opening of current carrying contacts. | (2 × 1) | (2) |
| 6.2 | 6.2.1 | Severe starting can cause the contacts of contactors to overheat and splatter or weld together. | | |
| | | OR | | |
| | | Fuses could deteriorate and may even melt. | | (1) |
| | 6.2.2 | The tripping current✓ as well as the time delay increases. ✓ | | (2) |
| 6.3 | 6.3.1 | Earth leakage unit | | |
| | 6.3.2 | Valve arrester | | |
| | 6.3.3 | Low voltage surge arrester | | |
| | 6.3.4 | Overload relay or fuse | | |
| | 6.3.5 | Circuit breaker | (5 × 1) | (5) |
| | | | | [10] |

QUESTION 7: MEASURING INSTRUMENTS

- | | | |
|-----|--|------------|
| 7.1 | The wattmeter measures the true power✓ consumed by the circuit. ✓ | (2) |
| 7.2 | A power – factor meter | (1) |
| 7.3 | A frequency meter is connected to a single – phase system across the live✓ and neutral conductors(in parallel) ✓ | (2) |
| 7.4 | A voltmeter is also connected in this manner. | (1) |
| | | [6] |

QUESTION 8: TRANSFORMERS

8.1 8.1.1 $\frac{v_1}{v_2} = \frac{n_1}{n_2}$

$$V_1 = \frac{380 \times 15}{1} \checkmark$$

$$= 5\,700 \text{ V} \checkmark$$

In delta V line is equal to V phase, therefore the value of voltage line is 380 v, both V line and V phase. ✓

$$V_L = \sqrt{3} \times V_{ph}$$

$$V_L = \sqrt{3} \times 5\,700$$

$$= 9\,861 \text{ V} \checkmark \quad (4)$$

8.1.2 $S = \sqrt{3} \times V_L \times I_L$

$$I_L = \frac{S}{380 \times \sqrt{3}} \checkmark$$

$$= \frac{300 \times 1\,000}{380 \times \sqrt{3}}$$

$$= 455,803 \text{ A} \checkmark \quad (2)$$

8.1.3 $V_L = V_{PH}$

$$I_L = \sqrt{3} \times I_{Ph}$$

$$I_{PH} = \frac{455,803}{\sqrt{3}} \checkmark$$

$$= 263,157 \text{ A} \checkmark \quad (2)$$

- 8.2 8.2.1 False
 8.2.2 True
 8.2.3 True
 8.2.4 True

(4 × 1) (4)
[12]

QUESTION 9: ELECTRONICS

9.1		<ul style="list-style-type: none"> • Low power • Medium power • High power 	(Any 2 × 1)	(2)
9.2	9.2.1	NPN✓ and PNP✓		(2)
	9.2.2	The base is inactive due to reverse bias conditions between the base and emitter and between the collector and base.✓ Only a small leakage current flows and the transistor is considered off or non-conducting.✓		(2)
9.3	9.3.1	Active		
	9.3.2	Avalanche breakdown voltage		
	9.3.3	Power		
	9.3.4	Continuous current		
			(4 × 1)	(4)
				[10]
			TOTAL:	100