



**higher education
& training**

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE ELECTRICAL TRADE THEORY N2

15 April 2021

This marking guideline consists of 6 pages.

QUESTION 1

1.1 $IFC = \frac{CIF \times A}{\sqrt{t}}$

$t = \left(\frac{CIF \times A}{IFC} \right)^2 \checkmark$

$t = \left(\frac{78 \times 35}{8,67 \times 1\,000} \right)^2 \checkmark$

$t = 0,099 \text{ sec} \checkmark$ (3)

1.2 Permissible volt drop = 5% × V supply

$= 0,05 \times 380 \checkmark$

$= 19 \text{ V} \checkmark$

Minimum permissible volt drop = 380 - 19 = 361 V ✓ (3)

1.3 When all conductors of an AC installation are carrying their design load, the difference in voltage (the voltage drop) between the point of supply and any point of outlet or terminals of fixed appliances shall not exceed 5% of the declared phase to neutral voltage.

OR

Maximum permissible voltage drop between the point of supply and the point of consumption during full load shall not exceed 5% of the declared phase-to-neutral voltage. (2)

- 1.4
- | | |
|-------|-------|
| 1.4.1 | True |
| 1.4.2 | False |
| 1.4.3 | True |
- (3 × 1) (3)
- [11]**

QUESTION 2

- 2.1 Power stations are not built closer to cities because of pollution and then not being close enough to the raw materials and water. (2)
- 2.2 Each subcircuit must be labelled at its respective circuit breaker. (1)
- 2.3
- | | | |
|-------|--|-----|
| 2.3.1 | Star | (1) |
| 2.3.2 | 380 V is obtained across any two phases and 220 V is obtained between a phase and the neutral conductor. | (2) |
- 2.4
- They insert interpole barriers.
 - They insert de-ion arc extinguishers.
 - The contacts are made of silver tungsten.
- (3)

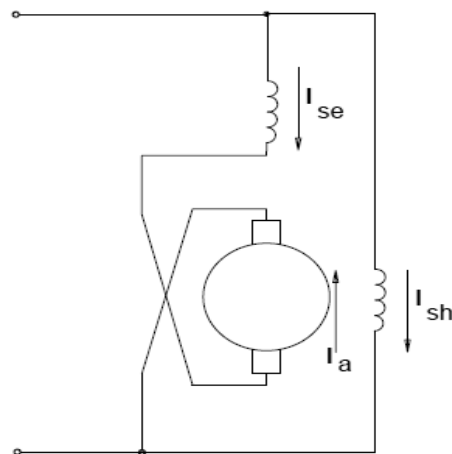
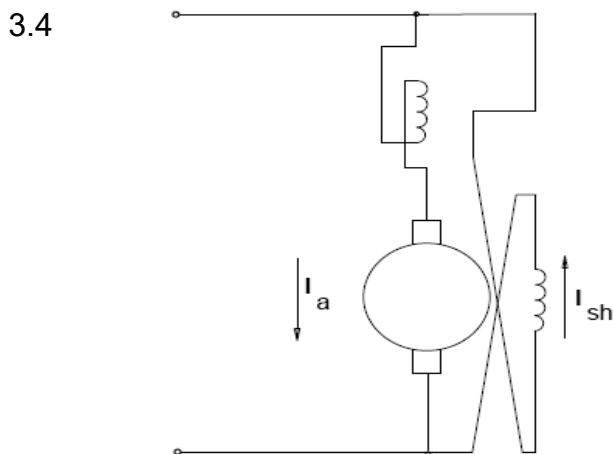
- 2.5 A disconnecter is a device used to disconnect the load from the supply only after the current has been interrupted by some other means, and a switch disconnecter is a device designed to handle electric arcing caused during switching.

(3)
[12]

QUESTION 3

- 3.1 The low starting torque. (1)
- 3.2 The dangerously high no-load speed. (1)
- 3.3 3.3.1 Current
3.3.2 Relay
3.3.3 Normally open
3.3.4 Normally closed

(4 × 1) (4)



(6)
[12]

QUESTION 4

- 4.1
- Stator frame
 - Stator core
 - Stator windings
- (Any × 2) (2)
- 4.2 4.2.1
- The electrical control is simple.
 - The electrical installation is simple.
 - Single-phase supplies are readily available.
- 4.2.2
- They are less efficient.
 - Available in small sizes.
 - They are not self-starting.

(2 × 3) (6)

- 4.3 • Star delta starter
 • Autotransformer (2)
- 4.4 To obtain a phase difference, an auxiliary winding of higher resistance and lower impedance is situated 90° mechanically away from the running winding and a capacitor is placed in series with this auxiliary winding. (3)
- 4.5 • Stator
 • Rotor (2)
- [15]**

QUESTION 5

- 5.1 5.1.1 Equipment earthing relates to the earthing of non-current carrying metal frames, enclosures, conduits, frames of machines and any other metallic structure that might make contact with a live conductor. (3)
- 5.1.2 Protective earthing. (1)
- 5.2 It is a terminal that is effectively and permanently earthed and to which the earth continuity conductor of the consumer's installation is permanently connected. (2)
- 5.3 This earth terminal is connected to the earth bar in the DB by means of the earth continuity conductor. The earth bar is then connected to the suppliers' protective earth by means of the earth lead. (4)
- 5.4 Earthing is important for safety of people and animals. When there is a leakage of current, it disconnects the supply if it is dangerous. (2)
- [12]**

QUESTION 6

- 6.1 6.1.1 Isolate the circuit from the supply once a dangerous earth-fault current is detected.
- 6.1.2 • They break the circuit when the current exceeds the fuse rating.
 • They open the circuit by rupturing when the current exceeds the designed value.
- 6.1.3 It is to trap any voltage surge and direct it to the ground immediately. (3 × 2) (6)
- 6.2 • A heating element.
 • A bimetal strip.
 • Snap-action contacts.
 • A reset device. (4)
- [10]**

QUESTION 7

7.1	7.1.1	Ammeter (possible to measure high currents).		
	7.1.2	<ul style="list-style-type: none"> • Megger. • Multimeter set on resistance scale. • Ohmmeter. 	(Any × 1)	
	7.1.3	<ul style="list-style-type: none"> • Multimeter set on voltage scale. • Voltmeter. 	(Any × 1)	
	7.1.4	Frequency meter.		
	7.1.5	A power-factor meter.		
	7.1.6	A maximum demand meter.	(6 × 1)	[6]

QUESTION 8:

8.1	8.1.1	$\frac{V_p}{V_s} = \frac{N_p}{N_s}$ $V_s = \frac{V_p \times N_s}{N_p} \checkmark$ $= \frac{2\,600 \times 1}{10}$ $= 260 \text{ V } \checkmark$		
	8.1.2	$\frac{V_p}{V_s} = \frac{I_s}{I_p} = \frac{N_p}{N_s}$ $I_s = \frac{V_p \times I_p}{V_s}$ $= \frac{2\,600 \times 30}{260} \checkmark$ $= 300 \text{ A } \checkmark$	OR $I_s = \frac{N_p \times I_p}{N_s}$ $= \frac{10 \times 30}{1}$ $= 300 \text{ A}$	(2 × 2) (4)
8.2	8.2.1	$P = 3 V_{PH} I_{PH} \cos \theta$ $P = 3 \times 250 \times 12 \times \cos 25 \checkmark$ $P = 8\,156,77 \text{ W}$ $P = 8,157 \text{ kW } \checkmark$		

$$8.2.2 \quad Q = 3 V_{PH} I_{PH} \sin \theta$$

$$Q = 3 \times 250 \times 12 \times \sin 25^\circ \checkmark$$

$$Q = 3\,803,564 \text{ VAr}$$

$$Q = 3,804 \text{ kVAr} \checkmark$$

(2 × 2) (4)

$$8.3 \quad 8.3.1 \quad V_{PH} = \frac{2200}{\sqrt{3}}$$

$$= 1\,270,171 \text{ V} \checkmark \quad (1)$$

$$8.3.2 \quad V_{PH} = \frac{380}{\sqrt{3}}$$

$$= 219,393 \text{ V} \checkmark \quad (1)$$

$$8.3.3 \quad T.R = \frac{V_{PH1}}{V_{PH2}} = \frac{1\,270,171}{219,393} \checkmark$$

$$= 5,79:1 \checkmark \quad (2)$$

[12]**QUESTION 9**

- 9.1
- Relay control
 - Motor speed control
 - Regulated power supplies
 - Battery chargers

- 9.2
- Open circuit
 - Short circuit

9.3 To allow an electric current to pass in one direction, called the diode's forward direction, while blocking it in the opposite direction.

9.4 To convert AC electricity to a stable DC voltage.

- 9.5
- Used as high speed electronic switches
 - Used as amplifiers

(5 × 2) **[10]****TOTAL: 100**