

2001- Electrical Service Technician “B” Answer Schedule

Note: (1 mark) means that the preceding statement earns 1 mark.

This schedule sets out the expected answers to the examination questions. The marker can exercise their discretion and decide on the overall adequacy of any answer that is presented in the candidate’s own words.

Question 1

- (a) • Check if the circuit is under an Out-of-Service tag and isolated. (1 mark)
- Add your own Danger Tag. (1 mark)
- Check and prove isolation using Prove-Test-Prove method. (1 mark)

- (b) • Connect the machine supply cord. (1 mark)
- Test insulation resistance – minimum 1 M Ω . (2 marks)
- Test continuity of protective earthing conductor from machine frame to known good earth - maximum of 1 ohm. (2 marks)

- (c) • Check all screens and guards are in place. (1 mark)
- Replace Danger Tag with Out-of-Service tag. (1 mark)

Question 2

- (a) The voltage drop along a two core flexible cord depends on the **resistance** and the **current carried**.
(2 marks)
- (b) When supplied at a constant voltage any decrease in the electrical resistance of any appliance will result in an increase in **current** and **the heat or power**.
(2 marks)
- (c) A thermally operated overload relay is designed to protect a circuit from the effects of a **sustained overload** (½ mark if only "overload" mentioned)
(1 mark)
- (d) The New Zealand low voltage ac supply operates at a frequency of **50Hz**
(1 mark)
- (e) The nominal voltage existing between a neutral conductor and earth in normal circumstances should ideally be **zero or nil**
(1 mark)
- (f) A double insulated appliance may be identified by the symbol **square within a square** (or symbol may be drawn)
(1 mark)
- (g) The minimum acceptable value for the insulation resistance between the phase windings of a three phase electric motor is **1 MΩ**
(1 mark)
- (h) Where the resistance and rated voltage of an appliance is known, its power rating in watts can be determined from the formula **$W = V^2 \div R$**
(1 mark)

Question 3

- (a) Phase to Phase= 400V or alternatively L1-L2, L1-L3, L2-L3 = 400V (1 mark)
Phase to Neutral = 230V or alternatively L1-N, L2-N, L3-N = 230V (1 mark)
Phase to Earth = 230V or alternatively L1-E, L2-E, L3-E = 230V (1 mark)
Neutral to Earth= Nil V (1 mark)
- (b) (i) A system of supply of electricity in which the neutral is connected to earth:
- at the source of supply (1 mark)
 - at points on the supply system (1 mark)
 - at every electrical installation connected to that system (1 mark)
- ER 2
- (ii) $230 - 11.5 = 218.5 \text{ V}$ ($230 \times 5\% = 11.5\text{V}$) (2 marks)
ER 53(3)(b)
- (iii) AS/NZS 3760 (1 mark)
ER 76(4)

Question 4

(a) Visual inspection

- Check with operator on the reported fault e.g., was:- the motor smoking, overheating, smell, shocks, etc (1 mark)
- Check for broken components, missing guards, live wires exposed etc. (1 mark)

(b) (i) Protective earthing continuity test:

- Check from machine frame to known good earth (not own PEC).
- Check PEC of machine
- Use low reading ohmmeter or multimeter, acceptable test result – 1 ohm or less
- If above 1 ohm, check security and integrity of earth connections. (2 marks)

(ii) A high protective earthing conductor resistance could:

- Leave machine frame alive in a phase to frame fault.
- Result in the protection not operating (2 marks)

(c) (i) Insulation resistance test:

- On circuit between phase(s) and neutral, phase(s) and earth and neutral and earth.
- On motor windings between each winding and earth.
- 500 V d.c. insulation resistance tester
Acceptable result - 1 M Ω or more
- Reading below 1 M Ω indicates insulation breakdown in circuit or winding. (2 marks)

- (ii) Insulation breakdown could cause fault to machine frame thereby creating a shock hazard. (2 marks)

Question 5

(a) (i) Any TWO of:

- * Continuity of the earthing system
- * Insulation resistance
- * Polarity
- * Correct circuit connects
- * Operation of RCDs

AS/NZS 3000: 6.3.3.1
(2 marks)

(ii) (1) Any ONE of:

- * To ensure that the earthing systems has been installed in a manner that will cause circuit protective devices to operate if there is a fault between live parts, other than the neutral, and the mass of earth.
- * Will ensure that electrical equipment parts that are earthed do not reach dangerous voltages when earth faults occur.

AS/NZS 3000: 6.3.3.2.1
(1 mark)

(2) To ensure that the insulation resistance between all live conductors and earth, or, as the case may be, all live parts and earth is adequate to ensure the integrity of the insulation.

AS/NZS 3000: 6.3.3.3.1
(1 mark)

(iii) * Ensure that protective earthing conductors do not carry current.
* Ensure no short circuit exists.

AS/NZS 3000: 6.3.3.5.1
(2 marks)

(b) (i) AS/NZS 3760

ER 38
(2 marks)

(ii) * Protective earthing conductor resistance – maximum 1 Ohm
* Insulation resistance – minimum 1 Megohm

AS/NZS 3760
(2 marks)

Question 6

- (a) Ingress protection. (1 mark)
- (b) The degree of protection against live or moving parts or ingress of foreign bodies. (2 marks)
- (c) The degree of protection against the harmful ingress of moisture or liquids. (2 marks)
- (d) The fitting is weather protected. (2 marks)
- (e) "5" represents protection against dust to allow satisfactory operation of the equipment.
"6" represents protection against conditions on a ship's deck or a strong jet of water. (3 marks)
- ,AS 1939 Supp. 1 1990

Question 7

- (a) • To prevent an arc from developing between the terminals when the fuse blows. (1 mark)
- It also ensures that the fuse element blows where required by concentrating heat in that area. (1 mark)
- Contain the arc against splattering outside of the covered section. (1 mark)
- (b) (i) Utilisation Category is the ratio of minimum fusing current to the current rating of the fuse.
- or
- $$\text{Utilisation Category} = \frac{\text{Minimum Fusing Current}}{\text{Current Rating}}$$
- (3 marks)
- (ii) The lower the Utilisation Category Factor, the less excess current is required to blow the fuse. (2 marks)
- (c) To ensure that the replacement fuse link will safely interrupt the prospective short circuit current level for that circuit. (2 marks)

Question 8

- (a) (i) • With all control switches on (1 mark)
- Test with a 500V insulation resistance tester from the appliance framework to both phase and neutral joined together. (2 marks)
- With electronic circuitry bridged out test with a 500V insulation resistance tester between phase – Earth and Neutral – Earth. (2 marks)
- (ii) To avoid damage to electronic components (1 mark)
- (iii) The result must not be less than 1 Megohm (1 mark)
- (b) Any THREE of:
- Visual inspection
 - Continuity of conductors
 - Polarity
 - Continuity of Earthing
- (3 marks)

Question 9

(a) (i) Any THREE of:

- * Completed such training as prescribed.
- * Has had such experience as prescribed.
- * Has completed training in resuscitation, safe working practices and testing.
- * Has passed the prescribed examinations.

EA 74
(3 marks)

(ii) (1) A practising licence

EA 95(1)
(1 mark)

(2) 30 June of the year it is stated to expire.
(also accept 1 July)

Electricity Amendment Act 1997 4(2)(b)
(1 mark)

(3) The Registrar

EA 96(1) or 100(4)
(1 mark)

(b) (i) (1) Safe working practices appropriate to the work being undertaken.
(2) Testing to ensure safety before/during and after completion of the work.
(3) Basic first aid
(4) CPR

ER 26(2)
(2 marks)

(b) • 24 months

or

• Safe working practices, testing and basic first aid at intervals not exceeding 14 months, CPR at intervals not exceeding 7 months.

ER 26(4)
(2 marks)

Question 10

- (a) • Identify each of the three motor windings at the motor terminal box. (2 marks)
- Using a 500V insulation resistance tester, test: (2 marks)
 - between each of the three windings; and (1 mark)
 - between each of the three windings and the motor framework (1 mark)
 - In each test the reading must be not less than 1 Megohm. (2 marks)
- (b) Disconnect the thermistor control unit before making an insulation resistance test on the thermistors or between the thermistors and the motor frame (2 marks)