

ESTB 2014 - Electrical Service Technician “B” Answer Schedule

- Notes:1. (1 mark) means that the preceding statement/answer earns 1 mark.
2. This schedule sets out the expected answers to the examination questions. The marker can exercise their discretion and decide on the overall accuracy of any answer that is presented in the candidate's own words.
3. Symbols and terms - alternatives
Power W or P
Voltage V or E or U
Phase Active
4. Key to abbreviated terms:
EA Electricity Act 1992
ER Electricity Regulations 1997
AS/NZS Australia and New Zealand Joint Standard
NZS New Zealand Standard
AS Australian Standard
ECP New Zealand Electrical Code of Practice
GK General Knowledge
5. Those parts of an answer that are under-lined indicate the parts required to be covered by a candidate.

Question 1

- (a) Means that there is no significant risk of injury or death to any person, or of damage to any property, as a result of the use of the works, electrical installations, fittings, electrical appliances, or associated equipment, or the passage of electricity through those works, electrical installations, fittings, electrical appliances, or associated equipment, as the case may be.
- ER69(2)
(2 marks)
- (b) (i) Brown (1 mark)
- (ii) Light blue or blue (1 mark)
- (c) Any ONE of:
- A supervisor of electrical work whose registration allows that supervisor to do the work
 - A registered person whose registration allows that person to do the work, where the registered person is under the supervision of a supervisor of electrical work whose registration allows that supervisor to do the work
 - A registered electrical service technician with 3 years experience.
- ER 23(a),(b)
(2 marks)
- (d) A nominal voltage of 230 volts between phase and neutral.
- ER 2
(2 marks)

- (e) A situation in which moisture is either permanently present, or intermittently present to such an extent as would be likely to impair the effectiveness or safety of an electrical installation which complies with this Standard for ordinary situations.

Ref: AS/NZS 3000: 1.4.37
(2 marks)

- (f) Any TWO of:

- Current rating
- Voltage rating
- Category of duty (Rupturing Capacity)
- Utilisation category (fusing factor) (Class)

(2 marks)

- (g) The motor will not start.

(2 marks)

- (h) Any TWO of:

- The appliance is fixed wired and connected through a continuous flexible cord to a supply of electricity from a source isolated from earth with a voltage between conductors not exceeding 250 volts:
- The appliance is supplied with electricity from a safety extra-low voltage source:
- The appliance is double-insulated and is supplied with electricity through a residual current device.

ER 77(3)(a)

ER 77(3)(b)

ER 77(3)(c)
(2 marks)

- (i) (i) $W = \frac{V^2}{R}$

(1 mark)

- (ii)
 - The current flow
 - or
 - The power dissipated

(1 mark)

- (j) Any FOUR of:

- Safety glasses or face shield
- Rubber insulating gloves
- Safety boots
- Full body cover overalls
- Ladder (safe working platform)

(2 marks)

Question 2

(a) Any THREE of:

- Length
- Cross-sectional area
- A cord with three conductors
- Colour Coding
- Mechanical strength if weight is to be supported?
- Sheath suitable for the environment
- Insulation suitable for application's temperature conditions

(3 marks)

(b)

COLOURS OF CABLE CORES		
Function	Identifying colours	
	Recommended	Alternative
<i>Earth/bonding</i>	<i>Green/yellow</i>	<i>Green</i>
<i>Active</i>	<i>Red</i>	<i>Any colour except green, black, light blue</i>

(3 marks)

Ref: AS/NZS 3000: Table 3.5

(c) (i) Voltage is dropped as the load current passes through the conductor resistance (1 mark)

(ii) • Use a flexible cord with an increased cross-sectional area (1 mark)

• Reduce the length of the cord (1 mark)

(d) It is the maximum current that a flexible cord is designed to carry safely (1 mark)

Question 3

(a) (i) Any ONE of:

- Detects excessive current drawn and coil is de-energised disconnecting the motor from the supply.
- Detects loss of one phase and coil is de-energised disconnecting the motor from the supply.

(1 mark)

(ii) Detects loss of one or more phases and coil is de-energised disconnecting the motor from the supply.

(1 mark)

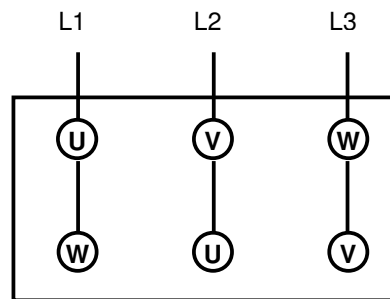
(iii) Detects incorrect polarity and prevents motor from running in the wrong direction.

(2 marks)

(b) (i) With an ohmmeter set on the lowest scale, test between each set of terminals in turn until the three lowest resistances between pairs of terminals is known.

(2 marks)

(ii)



- Correct supply
- Correct connections between windings
- Correct identification of terminals

(1 mark)

(2 marks)

(1 mark)

Note: Accept any method that clearly identifies the terminals

Question 4

- (a) (i) Meter capable of accurately reading values of 1 ohm or less.
or
Low resistance ohmmeter (1 mark)
- (ii) Test between the machine frame and a known good earth (not the machine's protective earth conductor) (1 mark)
- (iii) A high protective earth conductor resistance could leave machine frame alive in a phase to frame fault. (1 mark)
- (b) (i) 500V d.c. insulation resistance tester (1 mark)
- (ii) Test between each phase and earth and neutral and earth for the entire machine. (1 mark)
- (iii) Below 1 Mohm indicates insulation breakdown which could cause shocks or fault. (1 mark)
- (c) • Carry out PEC and insulation resistance test to confirm machine is safe to connect. (1 mark)
- Connect the machine supply cord and ensure the connections are correct (1 mark)
- Check all screens and guards are in place. (1 mark)
- Remove Danger Tag and check the machine for operational safety (current test, rotation check etc.). (1 mark)

Question 5

(a) The procedure has to cover:

- Identifying the correct fuses on the switchboard. (1 mark)
- Switching off the circuit power supply
Or
Removing the load from circuit
And
Removing fuse carriers. (1 mark)
- Attaching a Danger tag to the circuit. (1 mark)
- Removing the isolator cover and testing for voltage at the supply side of the isolator using the prove-test-prove method. (2 marks)

- (b)
- The control circuit operates at 230V. (1 mark)
 - The control circuit is connected to the phase on which there is no fault. (1 mark)
- or
- Each element is a single phase circuit with a common neutral (2 marks)

- (c) (i) Insulation resistance test. (½ mark)
- (ii)
- Test between each phase and earth between the load side of the isolator and the supply side of the contactor. (½ mark)
 - Test between each phase and earth on the supply side and load side of the contactor. (½ mark)
 - Test between each phase and earth of the conductors and elements on the supply side of the contactor (½ mark)

Alternative approach

- Test between each phase and earth on the load side of the isolator. (½ mark)
- Test between each phase and earth on the supply and load side of the contactor. (½ mark)
- Test between each phase and earth at the terminals of the elements (½ mark)

(iii) Possible faults are:

- Short between phase and earth on one phase in an element or in the wiring. (1/2 mark)
- Intermittent fault on one element or breaking down in the insulation between one phase and earth.
or
Element casing is split and element exposed.
or
Element has broken off where it joins the element collar and element exposed. (1/2 mark)

Question 6

- (a) (i) An overload:
- causes a bi-metal to heat up and bend, (1 mark)
 - operating a trip mechanism (1 mark)
- (ii) A short circuit
- causes a strong magnetic field in an armature circuit (1 mark)
 - which attracts a trip mechanism (1 mark)
- (iii)
- Has both a bimetal strip and an armature coil. (1 mark)
 - The bimetal protects and will operate on the occurrence of an overload. (1 mark)
 - The armature circuit will protect and act on the occurrence of a short circuit or sudden increase in current. (1 mark)
- (b) Any ONE of:
- The HRC fuses are capable of safely interrupting far higher levels of PSSC than the thermal overload in a fault situation
 - The HRC fuses operate much faster than the thermal overload under short circuit conditions, and they will disconnect the circuit before any damage occurs. (1 mark)
- (c) Any TWO of:
- If correctly threaded, prevents fuse element from bulging out the side of the carrier and being accessible to touch.
or
If incorrectly threaded, contact could be made with the fuse element.
 - If correctly threaded, under overload conditions the heat produced in the element is confined to the tunnel area.
or
If incorrectly threaded, the arc or molten metal may escape under overload conditions.
 - If correctly threaded, under short-circuit conditions the arc and molten element is confined within the fuse carrier and base.
or
If incorrectly threaded, the arc or molten metal may escape under fault conditions.
 - If correctly threaded, the fuse wire is sheltered in the tunnel and well clear of the terminals which act as a heat sink.
Or
If incorrectly threaded, will be slow to respond to overload fault. (2 marks)

Question 7

(a) Any TWO of:

- Lock the isolator in the off position.
- Open and lock the MCBs
- Disconnect the cables at the supply side of the isolator

(2 marks)

(b) • Switching off

There is no method for preventing the appliance being switched on.

or

Isolation

A secure method of removing the means for energy to be supplied to the appliance.

(1 mark)

(c) • First - prove the meter is operating correctly on a known live circuit.

(1 mark)

- Then – test that the circuit is isolated.

(1 mark)

- Then - prove again that the meter is still operating correctly on a known live circuit.

(1 mark)

(d) (i) Items of apparel and equipment worn by a person that are intended either to prevent the occurrence of harm to the person or to minimise any harm that may occur from hazards that are present in the workplace or hazards that may arise in the course of work

ER 2

(2 marks)

(ii) Any TWO of:

- Check that any associated equipment and personal protective equipment to be used by that person is in good order and condition.

ER 36(2)(a)

- Check that any associated equipment and personal protective equipment to be used by that person is safe for its intended use

ER 36(2)(a)

- To use the associated equipment and the personal protective equipment provided in a competent manner.

ER 36(2)(c)

(2 marks)

Question 8

(a) Any TWO of:

- Low resistance path to the star point
 - Parallel path to the star point.
 - Ties the voltage between phase and earth to 230V (standard low voltage)
- (2 marks)

(b) Any TWO of:

- The neutral conductor provides the return path to the distribution transformer for the “out-of-balance” current
 - The neutral conductor is required to ensure that the potential across each single phase load is 230V with respect to earth.
 - To make sure phase voltages are equal
- or
- The star point will shift and phase voltages will not be equal if there is no neutral
- (4 marks)

(c) Any ONE of:

- When the load on each phase is identical and no out of balance current exists
 - Load connected in delta.
 - The load is a three-phase induction motor
- (1 mark)

(d) • Provides a safeguard against electric shock by maintaining the machine framework at earth potential.

Or

- Ensures the circuit protection devices operate in the event of a phase (active) to framework short circuit.
- (2 marks)

(e) Any ONE of:

- When they are double insulated or Class II
 - When they are supplied from an isolating transformer
- (1 mark)

Question 9

- (a) (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)
- (ii) • At 24 month intervals
- 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)(a), (b)
(1 mark)
- (iii) The Electrical Workers Registration Board
- ER 12(1)
(1 mark)
- (iv) When working for payment or reward.
- ER 12(4)
(1 mark)
- (v) Any ONE of:
- Whether the applicant is actively engaged in doing the electrical work for which they are registered.
 - Whether the applicant has fulfilled the conditions in Schedule 5.
 - Where the applicant is not actively engaged in electrical work:
 - The date prescribed electrical work was last carried out; and
 - The type of prescribed electrical work carried out.
- ER 12(2)
(1 mark)
- (b) Any FOUR of:
- Registered electricians
 - Registered line mechanics
 - Registered electrical inspectors
 - Trainees
 - Persons who are authorised to carry out such work under a provisional licence
 - Qualified engineers
- EA 108 (2)
(4 marks)