

## ESTB 2033 - Electrical Service Technician "B" Answer Schedule

- Notes:
- (1 mark) means that the preceding statement/answer earns 1 mark.
  - This schedule sets out the accepted answers to the examination questions. A marker can exercise their discretion and decide on the overall accuracy of any answer that is presented in the candidate's own words.
  - Symbols and terms - alternatives  
Power                      W or P  
Voltage                    V or E or U  
Phase                      Active
  - 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
  - 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.
- ER 69(2)  
(2 marks)
- (b) Any TWO of:
- The wrong isolating switch has been operated.
  - The appliance is being fed from two different sources.
  - The isolating switch is switching the neutral conductor.
- (2 marks)
- (c) Any TWO of:
- Open circuited centrifugal switch
  - Open start winding
  - Open start winding circuit
- (2 marks)
- (d)
- When they are double insulated or Class II
  - When they are supplied from an isolating transformer
- (2 marks)

- (e) • Category of duty (Rupturing Capacity)  
• Utilisation category (fusing factor) (Class) (2 marks)

- (f) (i) Means that the fittings or appliances are deliberately disconnected from any source of electricity. ER2 (1 mark)

- (ii) Means charged with electricity so that a difference in voltage exists to earth or between conductors ER2 (1 mark)

- (g) Class I 6 months  
Class II 12 months

AS/NZS 3760:2001: Table 2  
AS/NZS 3760:2003: Table 2 (2 marks)

- (h) It affects the level of voltage drop in the cord (2 marks)

- (i) Any TWO of:

- The appliance is connected through a continuous flexible cord.
- The supply of electricity must be from a source isolated from earth
- The voltage between conductors must not exceed 250 volts: ER 77(3)(a) (2 marks)

- (j) (i) Three phase squirrel cage induction motor (1 mark)

- (ii) Any ONE of:

- A single-phase, split-phase motor
- A single-phase, capacitor-start motor
- A single-phase, capacitor-start, capacitor run motor

(1 mark)

## Question 2

- (a) • The supply would be short-circuited. (1 mark)
- A safety hazard – flash burns.  
or  
Meter and/or appliance components could be damaged. (1 mark)
- (b) If 0 volt reading is obtained it could lead to the conclusion that the appliance is not live, where in fact parts of it are live because the appliance load is open circuited (by a switch or element) (2 marks)
- (c) Any FOUR of:
- Ensure the correct instrument for the conditions is used.
  - Inspect instrument, clips, leads and probes to ensure they are in good condition.
  - Ensure correct function and range is selected on the instrument.
  - Ensure leads are correctly connected. (4 marks)
- (d) Any FOUR of:
- Insulation resistance test
  - Continuity of conductors
  - Verification of polarity
  - Continuity of Earthing
  - Live load test.
  - Correct circuit connections (2 marks)

### Question 3

- (a) Phase to Phase = 400V or alternatively L1-L2, L1-L3, L2-L3 = 400V  
Phase to Neutral = 230V or alternatively L1-N, L2-N, L3-N = 230V  
Phase to Earth = 230V or alternatively L1-E, L2-E, L3-E = 230V  
Neutral to Earth = 0 V
- (2 marks)

- (b) "Multiple Earthed Neutral System" or "MEN System" means a system of supply of electricity in which the neutral is connected to earth
- (a) at the source of supply; and  
(b) at points on the supply system; and  
(c) at every electrical installation connected to that system.
- (2 marks)  
Ref: ER 2

- (c) Any TWO of:
- When the load on each phase is identical and no out of balance current exists
  - When the load connected in delta
  - A three-phase motor (either star or delta connected)
- (4 marks)

- (d) (i) 50Hz (1 mark)
- (ii) 325 volts (1 mark)

**Question 4**

(a) Any FOUR of:

- Number of cores
- Colour Coding
- Mechanical strength if weight is to be supported.
- Sheath suitable for the environment
- Cord construction

(4 marks)

(b) (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)

(c) It is the maximum current that a flexible cord is designed to carry safely

(1 mark)

(d)

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

or

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

Note: The screen only has a coloured sleeve once it is terminated

(2 marks)

Ref: AS/NZS 3000: Table 3.5

**Question 5**

(a) AS/NZS 3760

ER 38(3)  
(1 mark)

(b)

<b>Type of test</b>	<b>Type of instrument required</b>	<b>Test result</b>
<b>Protective earthing conductor test</b>	<b><i>Ohmmeter or other instrument with a low reading ohms scale</i></b>	<b><i>1 ohm resistance - maximum</i></b>
<b>Insulation resistance test</b>	<b><i>Insulation resistance tester</i></b>	<b><i>10,000 ohms - minimum</i></b>
<b>Or</b>		
<b>Earth Leakage tester</b>	<b><i>PAT or earth leakage tester</i></b>	<b><i>5 mA</i></b>

(6 marks)

(c) Any **THREE** of – from AS/NZS 3760:2001:

- Check for obvious damage or defects in the accessories or plugs.
- Check that flexible cords are effectively anchored to equipment and plugs
- Check that the inner cores of flexible supply cords are not exposed or twisted;
- Check that the external sheaths are not cut, abraded, twisted, or damaged to such an extent that the insulation of the inner cores is visible
- Check that unprotected conductors or insulation tape are not in evidence.
- Check that any controls are in good working order i.e. they are secure, aligned and appropriately identified.
- Check that covers, guards and the like are secured in the manner intended by the manufacturer or supplier.
- Check that safety facilities and devices are in good working order.

AS/NZS 3760: 2.3.2

Or

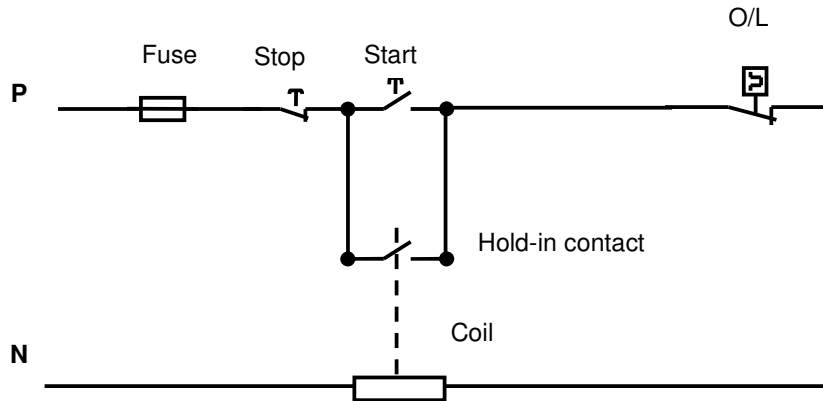
Any **FIVE** of – from AS/NZS 3760:2003:

- Check for obvious damage or defects in the accessories or plugs and for discolouration that may indicate exposure to heat, chemicals and moisture.
- Check that flexible cords are effectively anchored to equipment, plugs and cord extension sockets.
- Check that the inner cores of flexible supply cords are not exposed or twisted;
- Check that the external sheaths are not cut, abraded, twisted, or damaged to such an extent that the insulation of the inner cores is visible
- Check that unprotected conductors or banding insulation tape are not in evidence.
- Check that any operating controls are in good working order i.e. they are secure, aligned and appropriately identified.
- Check that covers, guards and the like are secured in the manner intended by the manufacturer or supplier.
- The pins of insulated pin plugs should be inspected for damage to the insulation of the pins.

AS/NZS 3760: 2.3.2  
(3 marks)

### Question 6

(a)



- Correct polarity (phase and neutral) (1 mark)
- Fuse protects the entire circuit (½ mark)
- Stop button controls the entire circuit (except the fuse) (½ mark)
- Start button correctly connected (½ mark)
- Hold-in contacts correctly connected (½ mark)
- Coil correctly connected (½ mark)
- Thermal overload correctly connected (½ mark)
- Working circuit (2 marks)

(b) (i) Any ONE of:

- To protect the motor against a sustained overload or over current.
  - To protect against the phase imbalance of single-phasing
- (2 marks)

(ii) The HRC fuses operate fast under excessive current conditions, and will disconnect the circuit before any damage occurs.

(2 marks)

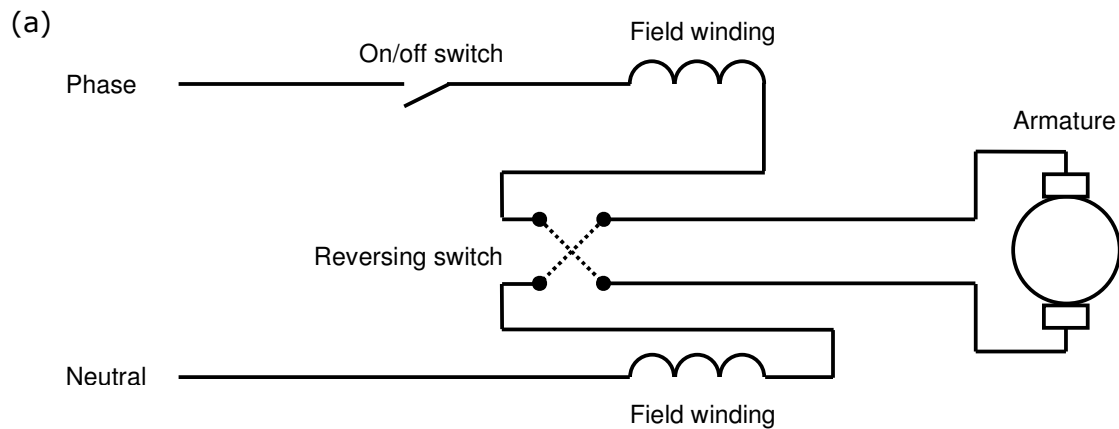
### Question 7

- (a) The maximum current that a fuse-link will carry continuously without deterioration or operating.  
OR  
The maximum level of protection for the circuit (2 marks)
- (b) (i) The fuse is under-rated for the circuit. (1 mark)
- (ii) Any ONE of:
- The fuse has is over-rated for the circuit.
  - The rupturing capacity of the fuse is too small (1 mark)
- (c) (i) • Detects the loss of voltage on a phase  
• Opens the control circuit and trips out the motor. (1 mark)
- (ii) • Detects the reversal of any two phases of the supply.  
• Opens the control circuit and trips out the motor. (1 mark)
- (d) Any TWO of:
- It prevents the fuse element from bulging out the side of the carrier and being accessible to touch.
  - Under overload conditions the heat produced in the element is confined to the tunnel area.
  - Under short-circuit conditions the arc and molten element is confined within the fuse carrier and base. (2 marks)
- (e) • an overload causes a bi-metal to heat up and bend, (1 mark)
- operating a trip mechanism (1 mark)

### Question 8

- (a) (i) Protective earthing conductor test  
Insulation resistance test (1 mark)
- (ii) Test 1 - protective earthing conductor test
- An ohmmeter  
Or  
Any meter that can accurately read values of 1 ohm or less (½ mark)
  - a testing between the PEC conductor of the flexible cord and the case of the cylinder (½ mark)
  - an expected test result of less than 1 ohm (½ mark)
  - the test result being a maximum value (½ mark)
- Test 2 insulation resistance test
- The description has to cover:
- the use of an insulation resistance tester (½ mark)
  - a 500V d.c. test voltage (½ mark)
  - testing between phase and earth and neutral and earth (½ mark)
  - an expected test result of more than 10,000 ohms or 0.01 Mohms (1 mark)
  - the test result being a minimum value (½ mark)
- (b) The procedure has to cover:
- Opening the correct protective device on the switchboard. (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)

### Question 9



- ½ marks for each correct conductor,
- 1½ marks for correct operation)

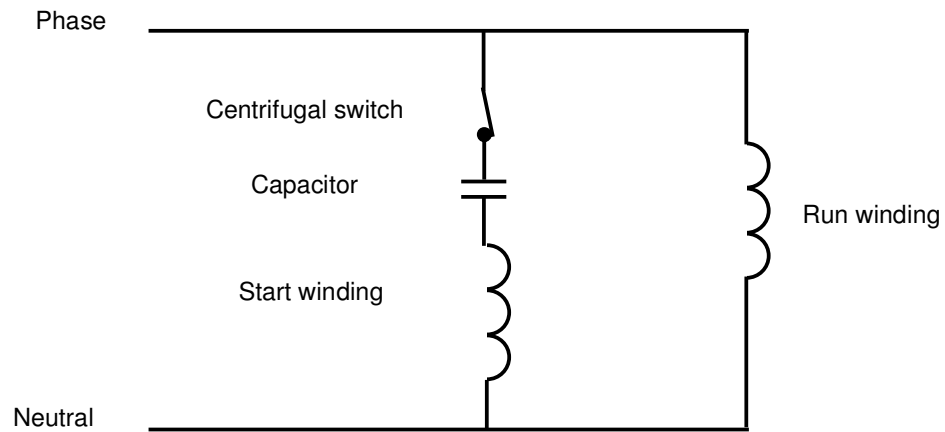
(5 marks)

(b) Any TWO of:

- High power-to-weight ratio.
- Higher torque.
- Can be easily speed controlled.
- High speeds available.

(2 marks)

(c) (i)



- Correctly connected start winding, capacitor and centrifugal switch (1½ marks)
- Correctly connected run winding (½ mark)

Note: An external relay or electronic device can be used in place of the centrifugal switch.

- (ii) Reverse the connections of the start winding.  
Or  
Reverse the connections of the run winding.

(1 mark)