

ESTB 2036 - 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) (i) 50Hz (1 mark)
- (ii) 325 volts (1 mark)
- (b) (i) Any One of:
- 230V, single phase split phase motor
 - 230V, single phase capacitor start motor.
 - 230V, single phase capacitor start-capacitor run motor.
- (1 mark)
- (ii) Any ONE of:
- A universal (series) motor.
 - A d.c. shunt motor
 - A d.c. series motor
 - A d.c. compound motor
- (1 mark)
- (c) • Current rating
- Utilisation category (fusing factor) (Class)
- (2 marks)

- (d) (i) (A) Two (1/2 mark)
 (B) In parallel (1/2 mark)
- (ii) (A) Two (1/2 mark)
 (b) In series (1/2 mark)

(e) Any TWO of -

- Other equipment could fail or stop during an essential operation (lift or elevator control circuit)
 - The motor intended to be disconnected is remains energised.
 - The motor intended to be disconnected is remains energised, creating a mechanical hazard if restarted.
- (2 marks)

(f) (i) Any ONE of:

- Phase failure relay
 - Thermal overload
- (1 mark)

(ii) Phase reversal protection (1 mark)

(g) 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)

(h) Phases Red or Any colour except green/yellow, green, black or light blue (1 mark)

Earth Green/yellow Or Green (1 mark)

AS/NZS 3000:2000 Table 3.5
 AS/NZS 3000:2007 Table 3.4

or

From Figure 3.2 of AS/NZS 3000: 2007

- Phases Red, white, dark blue
- Earth green

- (i) • A sustained overload
• The loss of one phase

(2 marks)

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

(2 marks)

Question 2

(a) Protective earthing conductor test then the insulation resistance test. (1 mark)

(b) The protective earthing conductor test is carried out first to ensure the protective earthing conductor is continuous and of a low resistance. (1 mark)

(c) Protective earthing conductor test

The description has to include:

- Use of an ohmmeter
or
An instrument that can read values of less than 1 ohm (1 mark)
- Testing between the end of the screen and the frame of the motor (1 mark)
- An acceptable test result is 1 ohm - maximum. (1 mark)

Insulation resistance test

The description has to include:

- Use of an insulation resistance tester (1 mark)
- Using a test voltage of 500v d.c. (1 mark)
- Testing between each winding and earth (1 mark)
- Testing between each winding (1 mark)
- An acceptable test result is 1 M Ω , minimum (1 mark)

Question 3

- (a) "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.

ER 2
(2 marks)

- (b) Phase to Phase - 400V
Phase to Neutral - 230V
Phase to Earth - 230V
Neutral to Earth - 0 V

(2 marks)

- (c) Any TWO of:

- The neutral ensures a low impedance fault loop on an earth fault.
- The lower the resistance of the fault circuit, the higher the fault current and the more reliable the operation of protection equipment (fuses and circuit breakers).
- Limits the voltage to the nominal phase voltage.
- Mass of earth provides an alternative return path for the current if neutral is lost.

(2 marks)

- (d) 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)

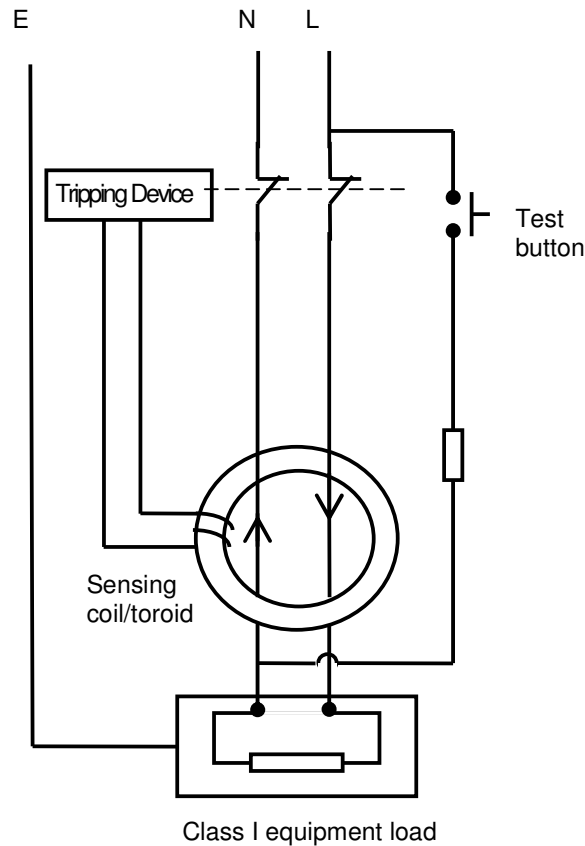
(2 marks)

- (e) • The neutral conductor provides the return path from the loads back to the distribution transformer for the resultant "out-of-balance" current from the three phases
- The neutral conductor is required to ensure that the potential across each single phase load is 230V with respect to earth.

(2 marks)

Question 4

(a)



- Correctly connected test circuit and resistance (1 mark)
 - Correctly connected sensing coil/toroid (1 mark)
 - Correctly connected phase, neutral and earth. (1 mark)
 - Correctly connected tripping circuit (1 mark)
- (b) (i) 300ms or 0.3 seconds (1 mark)
- (ii) 40ms or 0.04 seconds (1 mark)
- (c)
- Neutral current out of balance with the phase current. (1 mark)
 - A magnetic field is induced into the iron core. (1 mark)
 - The induced magnetic field induces a current in the sensing coil (1 mark)
 - The tripping coil is energised, opening the RCD contacts (1 mark)

Question 5

(a) The isolation method has to show:

- Identifying and removing the correct fuse. (1 mark)
- Testing for isolation at the supply side of the isolator using the prove-test-prove method. (2 marks)
- Locking off the isolator and attaching a danger tag. (2 marks)

(b) • Ensure that the conductors of the disconnected cable can be easily identified. (1 mark)

- Ensure that the disconnected cable ends are insulated and safe to touch. (1 mark)

- Ensure that the disconnected cables are protected against mechanical damage. (1 mark)

- Replace Danger Tag with Out of Service tag. (1 mark)

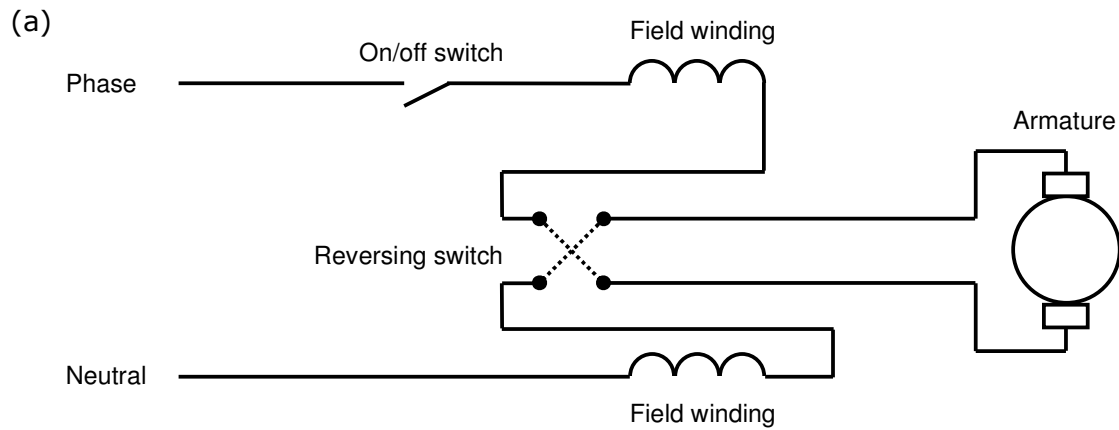
(c) • Insulation resistance test.

- Protective earthing conductor test (1 mark)

Question 6

- (a) • Protective earthing conductor test (½ mark)
- Any ONE of:
 - * Any meter that can accurately read values of less than 1Ω.
 - * An ohmmeter that is of Class 5 accuracy or better (½ mark)
 - 1Ω (½ mark)
 - Maximum (½ mark)
AS/NZS 3760: 2001: 2.3.3.1
AS/NZS 3760: 2003: 2.3.3.1
- Insulation resistance test (½ mark)
- Insulation resistance tester (½ mark)
 - 500 V d.c. (1 mark)
 - 1 MΩ (½ mark)
 - Minimum (½ mark)
AS/NZS 3760: 2001: 2.3.3.2
AS/NZS 3760: 2003: 2.3.3.2, Table
- (b) • Not less than 1 MΩ (½ mark)
- AS/NZS 3760: 2001: 2.3.3.3 or Appendix C3
Or
AS/NZS 3760: 2003: 2.3.3.3 (½ mark)
- (c) • To ensure that the control switch switches the active conductor.
• The active pin on the plug is connected to the active terminal in the appliance
• The neutral pin on the plug is connected to the neutral terminal in the appliance
• The earth pin on the plug is connected to the **frame** of the appliance. (4 marks)

Question 7



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

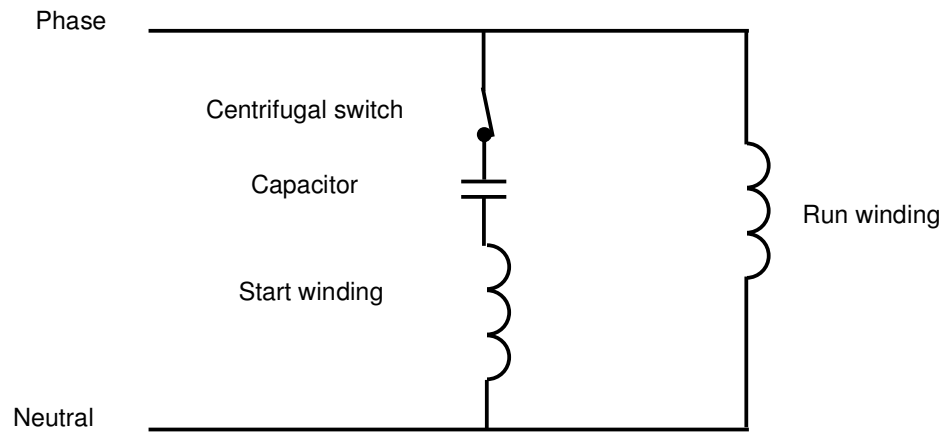
(5 marks)

(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.

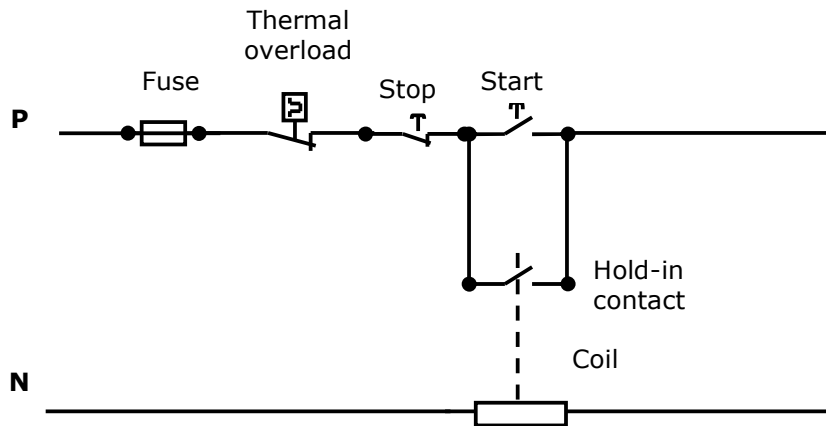
- (ii) Reverse the connections of the start winding.
Or
Reverse the connections of the run winding.

(1 mark)

Question 8

- (a) (i) Three phase induction motor (1 mark)
 (ii) A single-phase, permanent split capacitor motor (1 mark)

(b)



- Correct supply (phase and neutral) (1/2 mark)
 - Fuse protecting entire circuit (1/2 mark)
 - Stop correctly connected and controls entire circuit (except fuse) (1/2 mark)
 - Start correctly connected (1/2 mark)
 - Hold-in contacts correctly connected (1/2 mark)
 - Coil correctly connected (1/2 mark)
 - Thermal overload correctly connected (1/2 mark)
 - Working circuit (1 1/2 marks)
- (c)
- The excess line current caused by the mechanical overload causes heating in the motor windings. (2 marks)
 - The thermistor senses the rise in temperature and operates at a pre-set temperature level. (1 mark)

Question 9

- (a) (i) An overload causes a bi-metal to heat up and bend, (1 mark)
That operates a trip mechanism (1 mark)
- (ii) • A short circuit (or excessive current) causes a strong magnetic field in an armature circuit (1 mark)
• That attracts a trip mechanism (1 mark)
- (b) (i) • To protect the fixed wiring against excess current flow
or
• Safely interrupt and disconnect a faulty circuit (2 marks)
- (ii) To provide personal protection to the user of an appliance that is connected to the circuit controlled by the RCD.
or
To detect earth leakage and disconnect the faulty circuit (2 marks)
- (c) Any TWO of:
- It prevents 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)