

ESTB 2028 - 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) Thermal overload (2 marks)
- (b)
 - Category of duty (Rupturing Capacity)
 - Utilisation category (fusing factor) (Class) (2 marks)
- (c) (i) A nominal voltage of 230 volts between phase and neutral. (1 mark)
- (ii) Means any voltage exceeding 50 volts a.c. or 120 volts ripple free d.c. but not exceeding 1000 volts a.c. or 1500 volts d.c. (1 mark)
ER 2
- (d)
 - A symbol of a square within a square
 - The words "Class II" (2 marks)
- (e) (i) Three phase squirrel cage induction motor (1 mark)
- (ii) Any ONE Of: (1 mark)
- A single-phase, split-phase motor
 - A single-phase, capacitor start motor

(f) 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)

(g) (i) One element is open circuited

(ii) The same. In both switch positions only one element is working.

(2 marks)

(h) (i) A practising licence

EA 95(1)
(1 mark)

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

EA 100(2)(b)
(1 mark)

(i) • A fault in the fixed wiring or socket outlet

(1 mark)

• A registered electrician must be called to fix it

(1 mark)

(j) It affects the level of voltage drop in the cord

(2 marks)

Question 2

(a) To provide personal protection to the user of an appliance (2 marks)

(b) 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)

(c) The HRC fuses

- Can safely interrupt higher levels of fault current than the thermal overload. (1 mark)

- Operate much faster than the thermal overload. (1 mark)

(d) 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)

(e) (i) The fuse is under-rated for the circuit. (1 mark)

(ii) The fuse is over-rated for the circuit. (1 mark)

Question 3

(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) From AS/NZS 3000:2000: Table 3.5

Actives Any colour except green/yellow, green, black or light blue.
Earth Green or green/yellow

Or

From AS/NZS 3000:2007: Figure 3.2

- Actives Red, white, dark blue
Earth Green

Or

- Actives Brown, black, grey
Earth Green/yellow

(2 marks)

- (c) (i)
- Ensure there is no damage to the conductor cores (½ mark)
 - Ensure the basic insulation is up to the terminals. (½ mark)
 - Ensure the clamp secures the sheath of the cable and not the conductors (½ mark)
 - Ensure the conductors are tightly terminated to the correct terminals. (½ mark)
 - Ensure that the protective earthing conductor is longer than the other conductors, where possible. (½ mark)

(ii) Ensure there are no exposed conductors or exposed basic insulation. (½ mark)

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

Question 4

- (a) • The supply would be short-circuited. (2 marks)
- Meter protection would operate,
or
The circuit protection would operate.
or
A personal hazard – flash burns.
or
Meter and/or appliance components could be damaged. (1 mark)
- (b) Any THREE of:
- The instrument prevents the appliance from operating.
 - A 230 volt reading indicates only that the appliance is turned on.
 - A 230 volt reading indicates only that the appliance element is OK.
 - A 230 volt reading indicates only the supply voltage.
 - A 0 volt reading can lead to the false conclusion that the circuit is dead.
 - A 0 volt reading will be obtained if the appliance load is open circuited (by a switch or element) (3 marks)
- (c) • Use an insulation resistance tester (½ mark)
- Test voltage of 500V d.c (½ mark)
 - Test between each of the three windings. (1 mark)
 - Test between each of the three windings and the motor framework (1 mark)
 - Each test result must be not less than 1 Megohm. (1 mark)

Question 5

- (a) (i) Overload caused by too many appliances in use. (1 mark)
- (ii) • The fusing current is $20 \times 1.5 = 30\text{A}$ (1 mark)
- Total up the rating of appliances from their name-plates to establish that the total loading exceeds 30A. (1 mark)
- (iii) Recommend that fewer appliances be used. (1 mark)
- (b) (i) Any ONE of:
- A faulty appliance.
 - A reasonable description of the fault (1 mark)
- (ii) • On each appliance, carry out an insulation resistance test between the bridged out active and neutral and the frame of the appliance. (2 marks)
- Use an insulation resistance tester. (½ mark)
 - The test voltage is 500V d.c. (½ mark)
 - If there is a fault on the appliance the test result should be significantly less than $1\text{ M}\Omega$. (1 mark)
- (iii) Repair the faulty appliance
or
Put an "out-of-service tag" on the appliance and send away for repair. (1 mark)

Question 6

(a) Any THREE of:

- Inspect instrument, clips, leads and probes to ensure they are in good condition.
- Ensure correct function is selected on the instrument.
- Ensure correct (or highest) range is selected on the instrument.
- Ensure leads are correctly connected.

(3 marks)

(b) • To ensure that the test meter/instrument - is operating correctly.
• To ensure that the circuit has been isolated before it is worked on.

(2 marks)

(c) • The electrical service technician did not test between each phase and earth.

(1 mark)

- One phase was still live.

(1 mark)

(d) Any THREE of:

- Lock open of the isolating switch
- Lock open the MCB
- Disconnect the fixed wiring
- Attach a danger tag to the isolating switch

(3 marks)

Question 7

- (a) The neutral and phase currents are balanced. (1 mark)
- (b) • When an earth fault occurs, some current is diverted to earth (1 mark)
- This causes an imbalance between phase and neutral currents (1 mark)
- Which is detected by the sensing coil. (1 mark)
- Which trips and disconnects the supply to the load (1 mark)
- (c) RCD
- To ensure the tripping mechanism has not become stuck or "frozen"
or
- To ensure it works correctly (rapidly)
or
- PRCD
- To ensure the tripping mechanism has not become stuck or "frozen"
or
- To ensure PRCD does not reset to the "on" position after supply is re-established. (1 mark)
- (d) (i) 300ms or 0.3 seconds (1 mark)
- (ii) 40ms or 0.04 seconds (1 mark)
- (e) PRCDs are voltage dependent to ensure that, when supply is lost:
- Portable or hand-held appliances do not automatically restart when supply is restored. (1 mark)
- The PRCD has to be manually reset to restore the supply. (1 mark)

Question 8

(a) (i) Any ONE of:

- To ensure the frame of the motor stay at (or near) earth potential in event of a shock against electric shock by maintaining the machine framework at earth potential.
- To provide a low impedance path that will ensure the protection device operates in the event of a fault.

(2 marks)

(ii) To ensure the maximum current carrying capacity under fault conditions.

(1 mark)

(b) • The final subcircuit 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

(2 marks)

• The neutral conductor is required to ensure that the potential across each single phase load is 230V with respect to earth.

(2 marks)

(c) Any ONE of:

- When the load on each phase is identical there is no resulting "out-of-balance" so a neutral is not required.
- Where the load is delta-connected (for example, a motor)

(2 marks)

(d) "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

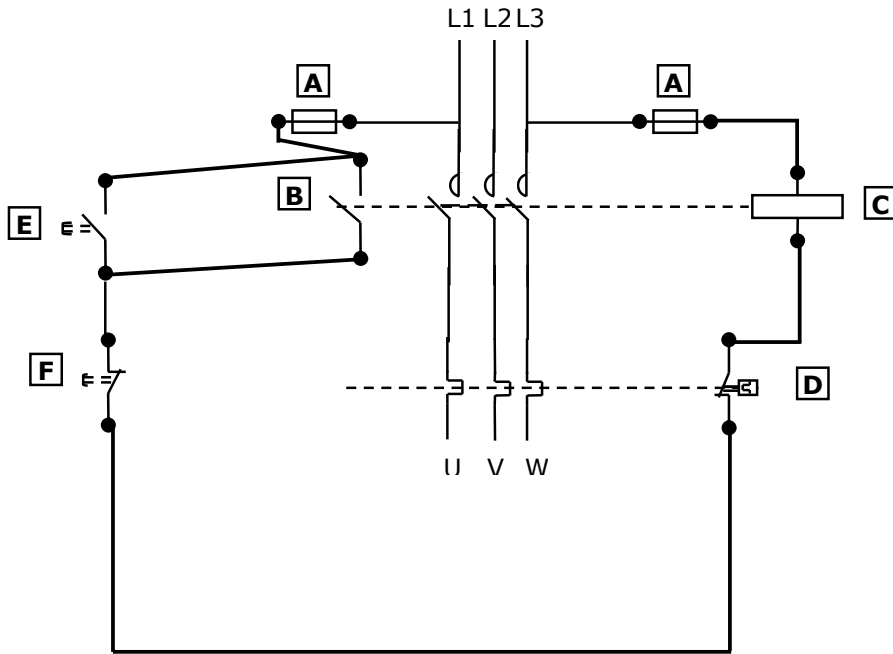
(c) at every electrical installation connected to that system.

ER 2

(1 mark)

Question 9

(a)



- ½ mark for each of the 6 wires added.
- 3 marks for an operation (and safe) circuit.

(6 marks)

- (b) (i) The motor would not be able to be started as the control circuit is open. (1 mark)
- (ii) The motor would start but the contactor would drop-out as soon as the pressure is released from the start button. (2 marks)
- (iii) The motor would not be able to be started as the control circuit is open. (1 mark)