

ESTB 2020 - 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 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.
 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) Interchange any two of the supply phase connections. (2 marks)
- (b) Any ONE of:
- To limit the effect of fault currents.
 - To provide back-up protection for thermal motor protection. (2 marks)
- (c) It effects the level of voltage drop in the cord (2 marks)
- (d)
 - Insulation resistance test
 - Visual inspection
 - Continuity of conductors
 - Verification of polarity
 - Continuity of Earthing
 - Guards in place.
 - Live load test.
 - Rotation Check (2 marks)
- (e) Any ONE Of:
- 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)

(f) In relation to fittings or electrical appliances, means that the fittings or appliances are deliberately disconnected from any source of electricity.

(2 marks)

(g) 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

ER2

(2 marks)

(h) Any TWO of:

- The wrong isolating switch has been operated.
- The wrong fuses or circuit breakers have been operated.
- The isolating switch is faulty.
- The circuit is being fed from two different sources.
- The isolating switch is not in the Active conductor.
- A capacitor has not been discharged.

(2 marks)

(i) Switches the load on/off on time basis independent of the load

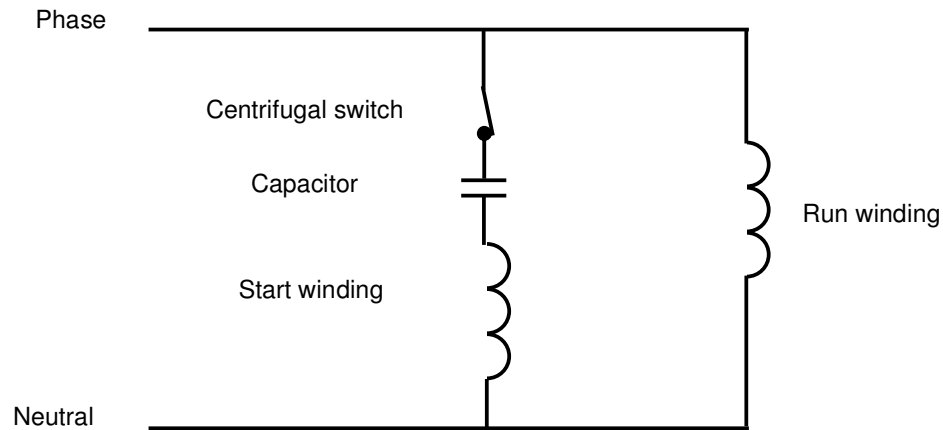
(2 marks)

(j) $20 \times 1.5 = 30A$

(2 marks)

Question 2

(a) (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 the run winding. (1 mark)

(iii) Any ONE of:

- To create torque to start the motor by causing a phase displacement between the start winding current and the run winding current.
 - Provides a leading current in the start winding.
- (2 marks)

(b) $746 \times 0.75 = 560$ watts (1 mark)

(c) Any TWO of:

- Open circuited or short-circuited or faulty capacitor
 - Open circuited centrifugal switch at rest
 - Open start winding circuit
- (2 marks)

(d) An intermittent fault on the run winding circuit (2 marks)

Question 3

(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 would blow well below the circuit full-load current.
• Will cause nuisance tripping

(1 mark)

(ii) The current could damage subcircuit wiring and fittings before the fuse operates.

(1 mark)

- (c) (i) • Detects the loss of voltage
• Opens the control circuit and trips out the motor.

(2 marks)

- (ii) • Detects the reversal of two phases of the supply.
• Opens the control circuit and trips out the motor.

(2 marks)

(d) 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.

(2 marks)

Question 4

- (a) Test: No.1 Protective earthing test
Instrument Instrument that can accurately read values of 1Ω or less
Result 1Ω maximum

ASZS 3760: 2001: 2.3.3.1
AS/NZS 3760: 2003: 2.3.3.1
(3 marks)

- Test No. 2 Insulation resistance test
Instrument Insulation resistance tester
Result $1\text{ M}\Omega$ minimum

AS/NZS 3760: 2001: 2.3.3.2
AS/NZS 3760: 2003: 2.3.3.2, Table
(3 marks)

- (b)
- The phase on the plug is connected to the phase terminal in the appliance
 - The neutral on the plug is connected to the neutral terminal in the appliance
 - The earth on the plug is connected to the frame of the appliance
 - The control switch is connected in the phase conductor.

(4 marks)

Question 5

(a) (i) ONE of:

- A degree of protection in accordance with AS 1939.
AS/NZS 3000: 1.4.58
- A coding system to indicate the degree of protection provided by the enclosure
AS 1939 supplement 1 – 1990
- Degrees of enclosure protection of electrical equipment
AS 60529
(2 marks)

(ii) Any ONE of:

- The degree of protection against solid objects and the protection of persons against access to hazardous parts.
AS/NZS 3000: 1.4.58
- The degree of protection of persons against live or moving parts inside the enclosure and and protection of the equipment against ingress of solid objects
AS 1939 supplement 1 – 1990
- Protection against solid objects
AS 60529
(1 mark)

(iii) Any ONE of:

- Degree of protection against entry of water with harmful effects
AS/NZS 3000: 1.4.58
- The degree of protection of equipment against the ingress of water or other liquids
AS 1939 supplement 1 – 1990
- Protection against liquids
AS 60529
(1 mark)

- (b) **5** Any ONE of
- Protection against entry of dust in sufficient quantities to interfere with the satisfactory operation of equipment.
AS 1939 supplement 1
 - Protected against dust – limited ingress permitted (no harmful deposit)
AS 60529
(2 marks)
- 6** Any ONE of:
- Protection against heavy seas or a strong jet of water from all practicable directions
. AS 1939 supplement 1
 - Protected against strong jets of water e.g., for use on ship decks – limited ingress permitted
AS 60529
(2 marks)
- (c) (i) Must have a minimum degree of protection of IPX4
AS/NZS 3000: 7.1.4.1(b) or Table 7.1
(1 mark)
- (ii) Must have a minimum degree of protection of IPX4
AS/NZS 3000: 7.1.4.1(b) or Table 7.1
(1 mark)

Question 6

(a) The procedure has to cover:

- Identifying the correct fuses on the switchboard. (½ 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. (½ mark)
- The control circuit is connected to the phase on which there is no fault. (½ mark)

(c) (i) Insulation resistance test. (½ mark)

- (ii) • Disconnect the neutral at the load side of the isolator. (1 mark)
- Test between each phase and earth at the load side of the isolator. (½ mark)
 - Test between each phase and earth on the load side of the contactor. (½ mark)

(iii) Possible faults are:

- Short between phase and earth on one phase in an element or in the wiring. (1 mark)
- In the wiring there is a breakdown in the insulation between one phase and earth.
or
One element has an insulation resistance of less than 10,000 ohms. (1 mark)

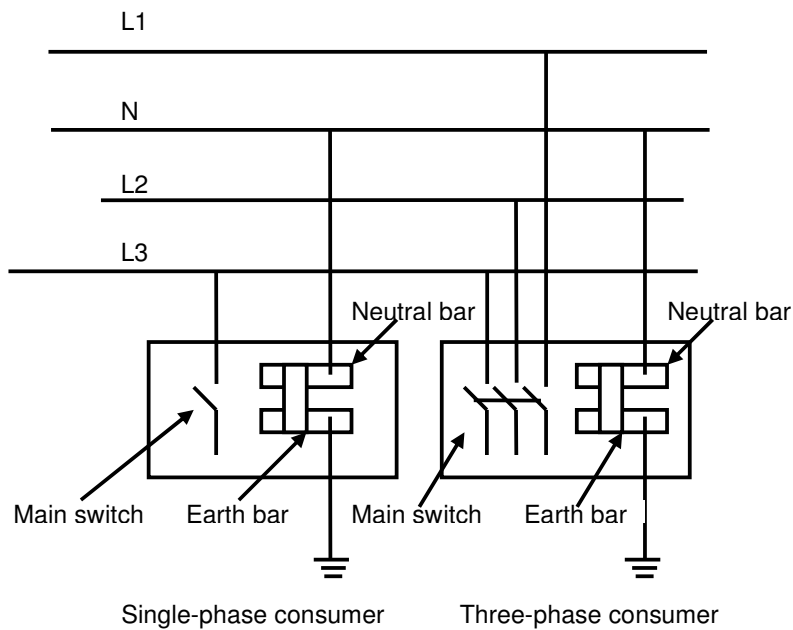
Question 7

- (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.

(2 marks)
Ref: ER 2

- (b) Any TWO of:
- Low resistance path to the star point at the distribution transformer
 - Parallel path to the star point at the distribution transformer
 - Ties the voltage between phase and earth to 230V (standard low voltage)
- (2 marks)

(c)



- Supply lines (1 mark)
- Single-phase consumer:
 - main switch (1/2 mark)
 - neutral bar connections. (1/2 mark)
 - earth bar connections. (1/2 mark)

- Three-phase consumer
 - main switch (½ mark)
 - neutral bar connections. (½ mark)
 - earth bar connections. (½ mark)

- Earthing arrangements
 - electrodes (1 mark)
 - links. (1 mark)

Question 8

(a) Detects loss of one phase. Coil is de-energised which opens the control circuit and disconnects the motor from the supply. (2 marks)

(b) (i) TWO of:

- Mechanical overload
- Supply voltage insufficient
- Loss of one line or circuit
- Seized motor
- Open circuited rotor
- Bearing fault (poling)
- Open circuited stator winding

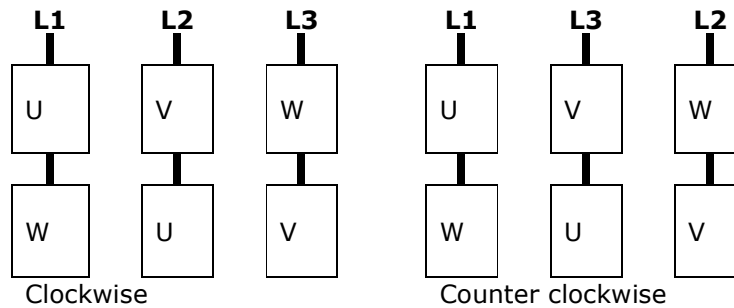
(2 marks)

(ii) Any TWO of

- Loss of one line
- Open circuited rotor bars
- Open or faulty windings
- Reversal of polarity of stator winding
- Bearing fault (poling)
- Mechanical overload

(2 marks)

(c)



(4 marks)

Question 9

- (a) • Neutral current equals the phase current. There is no out of balance current so no magnetic field is induced into the iron core. (1 mark)
- Because there is no induced magnetic field there is no induced current in the sensing coil (1 mark)
- The tripping coil is not energised. (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)