

## 2003- Electrical Service Technician “B” Answer Schedule

Note: (1 mark) means that the preceding statement earns 1 mark.

This schedule sets out the expected answers to the examination questions. The marker can exercise their discretion and decide on the overall adequacy of any answer that is presented in the candidate’s own words.

With calculation questions award ½ marks if only the correct answer is stated

### Question 1

(a)  $20 \times 1.5 = 30A$  (2 marks)

(b) Divide the wattage by 230 volts to find the current, then  $R = V/I$

*or alternatively*

$R = V^2/P$ , or  $I = W/V$ , then  $R = V/I$  (2 marks)

(c)  $746 \times 0.75 = 559.5$  watts (2 marks)

(d) (i) 1 Megohm  
(ii) 0.5 ohms (2 marks)

(e) Class I – Equipment in which protection against electric shock does not rely on basic insulation only, but in which includes an additional safety precaution in that accessible exposed conductive parts are connected to the protective earthing conductor in the fixed wiring of an electrical installation in such a way that accessible parts cannot become live in the event of failure of the basic insulation.

AS/NZS 3000: 1.4.25  
(2 marks)

### Question 2

(a) An area in which explosive atmospheres or dusts are or may be present and, that requires special precautions in respect of the use or construction of electrical appliances or fittings

ER 2  
(2 marks)

(b) There is no significant risk of injury or death to any person or damage to property from the use of electricity.

ER 69(2)  
(2 marks)

(c) Any TWO of:

- Withdrawal of fuses supplying the current plus attaching safety warning tag
- Locking open of appliance or circuit isolating switch plus attaching safety warning tag
- Tripping and locking open of supply circuit breaker, plus attaching safety warning tag
- Removal of appliance plug from socket, plus attaching safety warning tag to appliance
- Access permit or “hold card” system.

(2 marks)

(d) • Red

- Any other colour except black, green, green/yellow or light blue.

AS/NZS 3000: Table 3.5  
(2 marks)

(e) Any TWO of:

- The wiring is damaged, faulty or wrongly installed.
- The wrong isolating switch has been operated.
- The isolating switch is damaged or faulty
- The appliance is supplied from two sources
- There is a conductive path still present owing to humidity, dust, dirt allowing “tracking” across contacts.

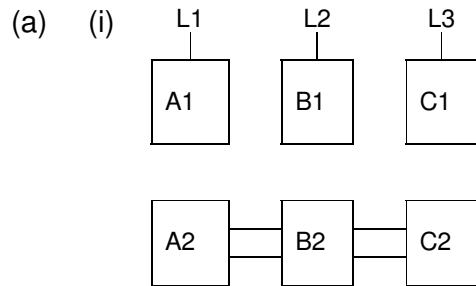
(2 marks)

### Question 3

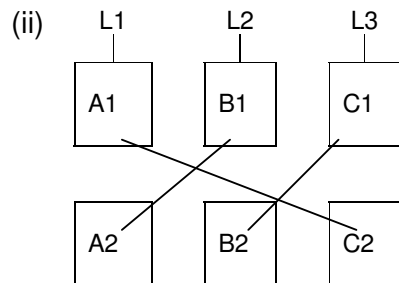
- Locate and identify the fuse on the switchboard for the electric cylinder. (1 mark)
- Switch off the circuit power supply and remove fuse carrier or lock MCB. (1 mark)
- Attach Danger tag to fuse base or MCB. (1 mark)
- Ensure that there are no exposed terminals in the fuse base. (1 mark)
- Remove the isolator cover and test for isolation power at the supply side of the isolator using the prove-test-prove method. (2 marks)
- Disconnect wiring from thermostat and element. (1 mark)
- Remove the wiring between the cylinder and the load side of the isolating switch. (1 mark)
- Replace Danger Tag with Out of Service tag. (1 mark)
- Advise the gas fitter that the work is completed and the electric cylinder is now safe to remove. (1 mark)

**Question 4**

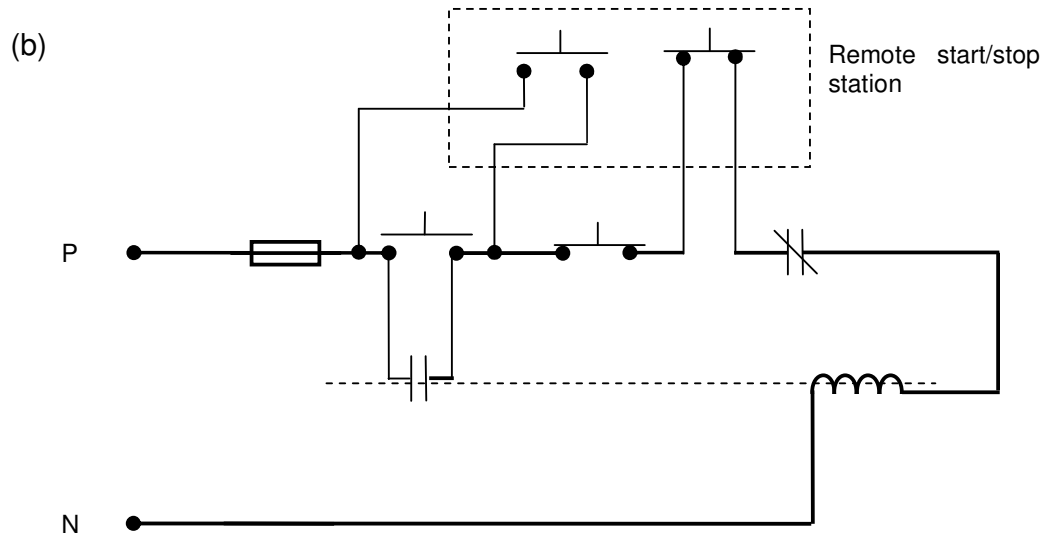
- (a)
- Remove straps from the terminal block (1 mark)
  - Identify each of the three motor windings at the motor terminal box. (1 mark)
  - Use a 500V d.c insulation resistance tester (1 mark)
    - Test between each of the three windings. (1 mark)
    - Each test result must be not less than 1 Megohm. (1 mark)
  - Test between each of the three windings and the motor framework (2 marks)
    - Each test result must be not less than 1 Megohm. (1 mark)
- (b) Disconnect the thermistor control circuit before making an insulation resistance test on the thermistors or between the thermistors and the motor frame. (2 marks)

**Question 5**

(2 marks)



(2 marks)



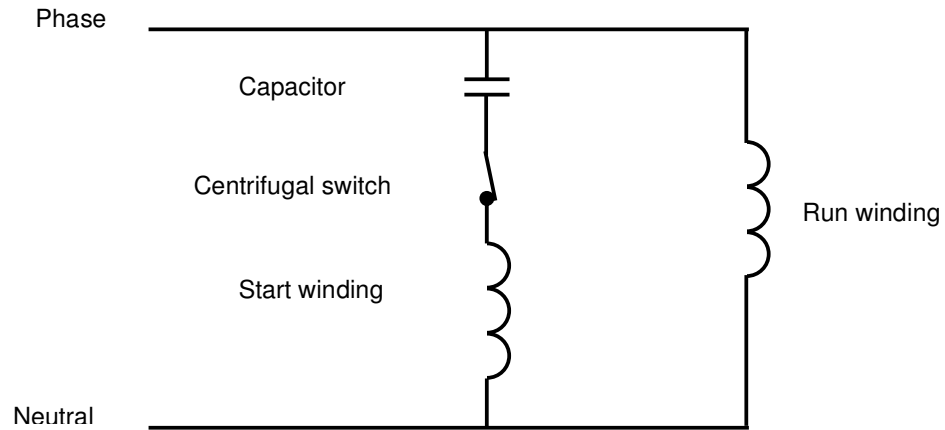
- Correct supply (phase and neutral) (½ mark)
- Fuse protecting circuit (½ mark)
- Stop/start station correctly connected (½ mark)
- Remote stop/start station correctly connected (2 marks)
- Hold-in contacts and coil correctly connected (2 marks)
- Thermal overload contacts correctly connected (½ mark)

**Question 6**

- (a) (i) Ohmmeter or any other instrument with a low reading ohms scale. (1 mark)
- (ii) • Check from machine frame to known good earth (not own protective earth conductor)  
• If above 0.5 ohm, check security of earth connections. (2 marks)
- (iii) A high protective earth conductor resistance could leave machine frame alive in a phase to frame fault. (2 marks)
- (b) (i) 500V d.c. insulation resistance tester (1 mark)
- (ii) Between each conductor, between each conductor and earth, between each conductor and neutral – include supply circuit and motor windings in test. (2 marks)
- (iii) Below 1 Mohm indicates insulation breakdown which could cause shocks or fault. (2 marks)

**Question 7**

(a) (i)



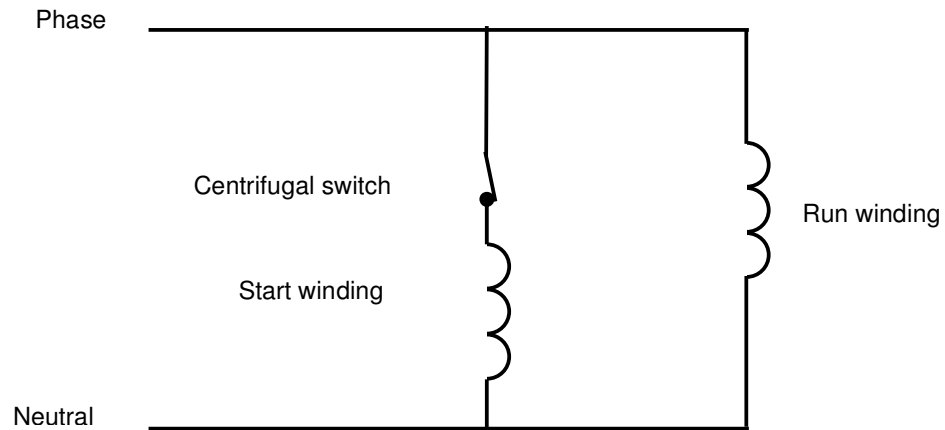
- Correctly connected start winding, capacitor and centrifugal switch  
(1½ marks)
- Correctly connected run winding  
(½ mark)

(ii) Reverse the connections on the start winding or the run winding but not both  
(2 marks)

(b) Reverse connections to either the field windings or armature windings (or brush-holder connections), but not to both with respect to the incoming supply conductors.

(2 marks)

(c) (i)



- Correctly connected start winding and centrifugal switch (1½ marks)
  - Correctly connected run winding (½ mark)
- (ii) Reverse the connections on the start winding or the run winding but not both (2 marks)

**Question 8**

- (a) 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.

AS/NZS 3000: 1.4.37  
(2 marks)

- (b) • A coding system to indicate the degree of protection provided by the enclosure  
• Against access to live parts from solid objects, or the ingress of water or other liquids

AS 1939 supplement 1 – 1990  
(2 marks)

- (c) (i) • The degree of protection of persons against live or moving parts inside the enclosure  
• And protection of the fitting against ingress of solid foreign bodies

AS 1939 supplement 1 – 1990  
(2 marks)

- (ii) The degree of protection of fittings against the ingress of water or other liquids

AS 1939 supplement 1 – 1990  
(2 marks)

- (d) • Protection against solid bodies greater than 1 mm  
• Protection against splashing water from all directions

AS 1939 supplement 1 – 1990  
(2 marks)

**Question 9**

- (a) • - A low resistance circuit/path to the distribution transformer via the parallel paths of the neutral and earth conductors. (2 marks)
- - This ensures a high fault current flow and rapid operation of the circuit protection. (2 marks)
- To ensure the maximum voltage to earth is 230V. (2 marks)
- (b) • Phase currents on each phase would be different
- The neutral provides the return path to the distribution transformer for the resultant out of balance current from the phases (3 marks)
- (c) Any ONE of:
- When the load on each phase is identical and no out of balance current exists
- Load connected in delta (1 mark)

**Question 10**

- (a) A bi-metal strip bends when heated and trips the circuit breaker out the heating of the strip is caused by the current flowing through it – or through a heater coil. (2 marks)
- (b) As the current increases, the magnetic field increases, and at a predetermined point, it attracts an armature that trips out the circuit breaker. (2 marks)
- (c) Combined thermal/magnetic breakers have both a bimetal strip and an armature coil. The bimetal protects and will operate on the occurrence of a sustained overload and the armature circuit will protect and act on the occurrence of a short circuit or sudden increase in current. (3 marks)
- (d) 6kA The maximum prospective short circuit current the breaker can safely open under fault conditions. (2 marks)
- 16A Is the nominal current rating of the breaker in normal service. (1 mark)