

# TEWC 137 - TRADESPERSONS ELECTRICAL WORK CERTIFICATE MARKING SCHEDULE

- Notes:
1. (1 mark) means that the preceding statement/answer earns 1 mark.
  2. This schedule sets out the expected answers to the examination questions. The 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.

## Section 1 – All Candidates

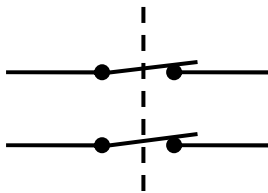
### Question 1

- (a) (i) **Single pole switch** shown in the **off** position.



(1 mark)

- (ii) **Double pole switch** shown in the **on** position.



(1 mark)

- (b) A fault to earth on both appliances could result in a potential difference between appliances.

(2 marks)

(c)  $I = \frac{W}{V}$  (1/2 mark)

$= \frac{1500}{230}$  (1/2 mark)

$= 6.52 \text{ A}$  (1 mark)

(d) Any TWO of:

- The appliance is fixed wired and connected through a continuous flexible cord to a supply of electricity from a source isolated from earth with a voltage between conductors not exceeding 250 volts: Ref: ER 77(3)(a)
- The appliance is supplied with electricity from a safety extra-low voltage source. Ref: ER 77(3)(b)
- The appliance is double insulated and is supplied with electricity through a RCD Ref: ER 77(3)(c)
- The appliance is supplied with electricity from a monitored earth circuit where the supply to the appliance is automatically disconnected in the event of the earth to the appliance being broken or disconnected: Ref: ER 77(4)(b)
- The appliance is supplied with electricity from a source connected to earth in such a way that the voltage to earth will not exceed 55 volts a.c: Ref: ER 77(4)(c)
- The appliance is supplied with electricity through a RCD Ref: ER 77(4)(d)
- The appliance is supplied with electricity from a source isolated from earth with a voltage between conductors not exceeding 250 volts Ref: ER 77(4)(e)
- The appliance is double insulated: Ref: ER 77(4)(f)  
(2 marks)

(e) Any TWO of:

- Building site under construction.
  - Outdoor area.
  - Factory with concrete floor and steel supports.
  - Bathroom or any damp indoor situation.
- (2 marks)

(f) It is the maximum fault current that a fuse or circuit breaker can safely interrupt.  
(2 marks)

(g) Any TWO of:

- If covers are left off basic insulation will be exposed.

- If covers are left off live terminals will be exposed.
- If covers are left off moving parts will be exposed.
- If covers are unsecured access can be gained to live terminals.
- If covers are unsecured access can be gained to basic insulation.
- If covers are unsecured access can be gained to moving parts.

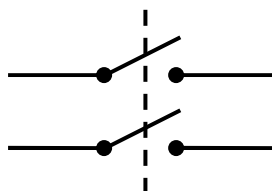
(2 marks)

- (h) (i) **Single pole switch** shown in the **on** position.



(1 mark)

- (ii) **Double pole switch** shown in the **off** position.



(1 mark)

- (i) Any TWO of:

- By use of the appropriate wording - double insulation.
- By use of the international symbol for double insulated equipment.
- By the wording **Class II** on the appliance.

(2 marks)

- (j)
- A fusible link will isolate a circuit when the ambient temperature reaches an unsafe level.
  - A fuse will isolate a circuit when excess current flows.

(2 marks)

## Question 2

- (a) 45A is the current rating.  
415V is the maximum nominal circuit voltage of the circuit.  
AC 46 is the category of duty (i.e. 46,000A prospective short-circuit current).  
(3 marks)

(b) 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 fault 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.
- If correctly threaded, the fuse wire is sheltered in the tunnel and well clear of the terminals which act as a heat sink.  
Or  
If incorrectly threaded, will be slow to respond to overload fault.

(3 marks)

(c) Any THREE of:

- If the fuse blows again an arc may be established between the fuse terminals causing damage or injury
- Cannot safely interrupt short circuit currents of much higher values.
- Fuse wire may protrude past the holder which creates an exposure to shock.
- Suitable fixing for the fuse wire is not generally available.
- Fuse holder is not fire proof.
- Slower operation/acting.

(d) Any TWO of:

- It will safely interrupt short circuit currents of much higher values or higher rupturing capacity.
- It eliminates arcing because the fuse element is sealed.
- It is obtainable in a range of Utilisation category (fusing factors).
- Current rating is clearly marked.
- Reliable operation within prescribed limits.
- Good discrimination.
- Constant fusing characteristics.
- Faster operation/acting.
- Doesn't deteriorate over time.

(2 marks)

### Question 3

(a) Any **THREE** of:

- High electrical resistance or dielectric strength.
- Good flexibility.
- Non absorbent.
- Withstands mechanical stress.
- Withstands corrosive environment (eg. u.v, oils, chemicals, etc).
- Withstands the temperature range of environment conditions to which it will be exposed.
- Withstands heat from the circuit conductors.
- Abrasion resistance.
- Solvent resistance.

(3 marks)

(b) (i) It is the maximum current that a flexible cord is designed to carry safely without overheating.

(2 marks)

- (ii)
- Current flow in excess of the rating will produce excess heat.
  - Excess heat may cause the insulation to deteriorate and breakdown and create a fire risk

(3 marks)

(c) Means in relation to conductors and other fittings, means that the conductors or other fittings are covered with insulation in such a manner that a person may safely handle them when they are live

(2 marks)

#### Question 4

(a) Parallel resistances  
 $R_p = \frac{\text{Product}}{\text{Sum}}$

(1/2 mark)

$$= \frac{15 \times 15}{15 + 15}$$

(1/2 mark)

$$= 7.5 \Omega$$

(1 mark)

$$R_t = R_s + R_p$$

(1/2 mark)

$$= 40 + 7.5$$

(1/2 mark)

$$= 47.5 \Omega$$

(1 mark)

$$I = \frac{V}{R}$$

(1/2 mark)

$$= \frac{230}{47.5}$$

(1/2 mark)

$$= 4.84 \text{ A}$$

(1 mark)

(b)  $W = V I$

(1/2 mark)

$$= 230 \times 4.84$$

(1/2 mark)

$$= 1113.2 \text{ or } 1.11 \text{ kW W}$$

(1 mark)

(c) 5 A or 6 A

(1 mark)

(d) 230 V

(1 mark)

## Section 2 - Plumbers Only

### Question 5

- (a) (i) Two. (1 mark)
- (ii) Phase (active)            Brown or Red .  
Neutral                        Blue/Light Blue or Black (2 marks)
- (b) (i) If strain is applied to the flexible cord the protective earthing conductor (earth continuity conductor) will be the last to pull away from the terminals. (2 marks)
- (ii) If all conductors are the same length, the earth may pull away first leaving the appliance operational but unearthed. (2 marks)
- (c) Any THREE of:
- Number of cores required.
  - Mechanical strength.
  - Environmental conditions.
  - Flexibility required.
  - Temperature at point of entry to appliance.
  - Shape.
  - Voltage rating
  - Current rating
  - Length
  - Size
- (3 marks)

### Question 6

- (a) 1. Locate and identify the fuse on the switchboard for the electric cylinder. (1 mark)
2. Switch off the circuit power supply  
or  
Ensure load is removed from circuit  
and  
Remove fuse carrier. (1 mark)
3. Attach Danger tag to fuse base. (1 mark)
4. Remove the isolator cover and test for isolation power at the supply side of the isolator using the prove-test-prove method. (2 marks)

Note: No.s 1 and 2 must occur first, No.s 3 and 4 can be in any order.

- (b) • Disconnect wiring from thermostat and element. (1 mark)
- Remove the wiring between the cylinder and the load side of the isolating switch. (1 mark)
- (c) • Ensure the cover is securely replaced on the isolator (1 mark)
- Replace Danger tag with Out of Service tag. (1 mark)
- Advise the supervisor that the work is completed and the electric cylinder is now safe to remove. (1 mark)

### Question 7

(a) (i)  $I = \frac{W}{V}$  (½ mark)

$= \frac{3000}{230}$  (½ mark)

$= 13.04 \text{ amps.}$  (1 mark)

The permanent connection unit is not of an adequate rating to supply the 3000W element. (1 mark)

(ii) Any TWO of:

- Is the current rating of the thermostat adequate to handle the extra current drawn?
- Are the sub circuit cables of an adequate rating to supply the new element?
- Is the sub-circuit fuse of the appropriate rating?

(2 marks)

(iii) The person carrying out the repair/replacement.

(1 mark)

(b)

Fixed Wiring Colours	Polarity	Appliance Colours	Conductor
<b>Red</b>	Phase	<b>Brown</b>	
Black	Neutral	<b>Blue</b>	
Green	Earth	<b>Yellow/Green</b>	

(2 marks)

(c) Any TWO of:

- There would be exposed live terminals in the fuse base.
- The circuit can be easily relivened by inserting a fuse carrier in the fuse.
- Don't need a tool to reliven.

(2 marks)

### Question 8

- (a) Any THREE of:
- TPS cable entering the switch with bare exposed basic insulation.
  - Broken switch cover.
  - Flexible conduit removed from its clamp.
  - Cover off the element thermostat enclosure or not fitted.
- (3 marks)
- (b)
- To prevent basic insulation from being exposed.
  - To prevent the connections pulling away in the event of strain on the flexible cord.
- (2 marks)
- (c) (i) Most of the internal wiring remain alive at 230V to earth
- (1 mark)
- (ii) Any TWO of:
- The phase and neutral can be transposed at the plug on the flexible cord.
  - The phase and neutral can be transposed at the internal terminals in the appliance.
  - The phase and neutral can be transposed in an extension cord supplying the appliance.
- (2 marks)
- (d) 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, e.g., main and control supplies.
- (2 marks)

### Question 9

- (a) (i) It must be able to read low ohms. (1 mark)
- (ii) Any TWO of:
- To check that the instrument is functional.
  - To zero the meter for accuracy.
  - Compensate for the resistance of the leads. (2 marks)
- (iii) • It may show an apparent reading of zero. (1 mark)
- It may be inaccurate when the protective earthing conductor (earth continuity conductor) resistance is high. (1 mark)
- (b) Any THREE of:
- The supply and/or the appliance would be short-circuited because the ammeter is low impedance.
  - Personal hazard – flash burns.
  - Meter and/or circuit protection would operate.
  - Meter and/or appliance components could be damaged. (3 marks)
- (c) A standard multimeter or ohmmeter only applies a very low voltage which won't expose any weakness in the insulation resistance. (2 marks)

## Section 3 – Gasfitters Only

### Question 10

- (a)
- To ensure that all exposed metal is at earth potential.
  - Maintains zero volts between all services which reduces the risk of electric shock or fire.

(3 marks)

- (b)
- The concrete and steel structure is in contact with the general earth mass.
  - The concrete and steel structure is conductive.

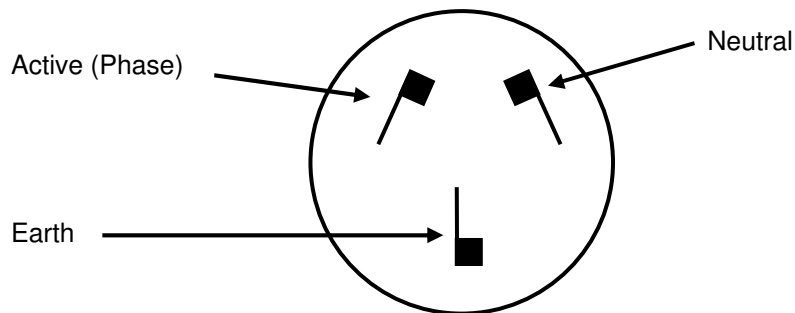
(2 marks)

AS/NZS 3000: 1.4.4.1

- (c) So that the earth pin:
- Is first to make contact when inserted,
  - And the last to break contact when the plug is withdrawn,

(2 marks)

(d)



(3 marks)

## Question 11

- (a) Any THREE of:
- TPS cable entering the switch with bare exposed basic insulation.
  - Broken switch cover.
  - Flexible conduit removed from its clamp.
  - Cover off the element thermostat enclosure or not fitted.
- (3 marks)
- (b)
- To prevent basic insulation from being exposed.
  - To prevent the connections pulling away in the event of strain on the flexible cord.
- (2 marks)
- (c) (i) Most of the internal wiring remain alive at 230V to earth
- (1 mark)
- (ii) Any TWO of:
- The phase and neutral can be transposed at the plug on the flexible cord.
  - The phase and neutral can be transposed at the internal terminals in the appliance.
  - The phase and neutral can be transposed in an extension cord supplying the appliance.
- (2 marks)
- (d) 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, e.g., main and control supplies.
- (2 marks)

## Question 12

- (a) (i) It must be able to read low ohms. (1 mark)
- (ii) Any TWO of:
- To check that the instrument is functional.
  - To zero the meter for accuracy.
  - Compensate for the resistance of the leads. (2 marks)
- (iii) • It may show an apparent reading of zero. (1 mark)
- It may be inaccurate when the protective earthing conductor (earth continuity conductor) resistance is high. (1 mark)
- (b) Any THREE of:
- The supply and/or the appliance would be short-circuited because the ammeter is low impedance.
  - Personal hazard – flash burns.
  - Meter and/or circuit protection would operate.
  - Meter and/or appliance components could be damaged. (3 marks)
- (c) A standard multimeter or ohmmeter only applies a very low voltage which won't expose any weakness in the insulation resistance. (2 marks)

### Question 13

- (a) 1. Locate and identify the fuse on the switchboard for the electric cylinder. (1 mark)
2. Switch off the circuit power supply
- or
- Ensure load is removed from circuit
- and
- Remove fuse carrier. (1 mark)
3. Attach Danger tag to fuse base. (1 mark)
4. Remove the isolator cover and test for isolation power at the supply side of the isolator using the prove-test-prove method. (2 marks)

Note: No.s 1 and 2 must occur first, No.s 3 and 4 can be in any order.

- (b) • Disconnect wiring from thermostat and element. (1 mark)
- Remove the wiring between the cylinder and the load side of the isolating switch. (1 mark)
- (c) • Ensure the cover is securely replaced on the isolator (1 mark)
- Replace Danger tag with Out of Service tag. (1 mark)
- Advise the supervisor that the work is completed and the electric cylinder is now safe to remove. (1 mark)

#### Question 14

- (a) • To avoid possible contact with a live terminal when removing or replacing the fuse carrier. (1 mark)
- To avoid flash burns from the fuse if it fails again because the initial fault has not been cleared. (1 mark)
- (b) • Switch off the load on the particular fuse circuit where possible.
- Hold face well back and averted when withdrawing/replacing the carrier.  
or  
Wear safety glasses
- Withdraw, and replace, carrier with firm, fast action. (3 marks)
- (c) • Check the test instrument on a known live source to prove that the meter is working correctly. (2 marks)
- Test for isolation (between all conductors) on the circuit being isolated. (1 mark)
- Re-check the test instrument on the known live source to confirm that it still works correctly. (2 marks)