

TEWC 136 - 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

Section 1 – All Candidates

Question 1

- (a) There is no significant risk of injury or death to any person or damage to any property as a result of the use of electricity.
ER 69(2)
(2 marks)
- (b) Any TWO of:
- An isolating transformer
 - An RCD affording personal protection
 - Monitored earth unit.
- (2 marks)
- (c) Any TWO of:
- Ensure appliance is isolated before connecting instruments.
 - Maintain adequate insulation and clearance between instrument clips, leads and probes.
 - Avoid personal contact with either live conductors or earth when using instruments on live circuits.
 - Leads are in good condition.
 - Ensure the correct range is selected on the instrument.
 - Wear protective goggles (PPE).
- (2 marks)
- (d) Any ONE of:
- A test voltage of 500V is required.
 - To stress the insulation and detect any weakness.
- (2 marks)

(e) 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)

(f) A fault to earth on both appliances at the same time could result in a 230 volt potential between appliances.

(2 marks)

(g) Any ONE of:

- A reading of 0Ω is no assurance that the protective earthing conductor resistance is less than 1Ω .
- Will not provide an accurate measurement of low resistance values.

(2 marks)

(h) • Prove the instrument is working on a known live source both before and after the testing for presence of voltage.
• That the circuit to be worked on has been correctly isolated and is safe to work on.

(2 marks)

(i) They may not undertake work that is beyond their experience or ability.

(2 marks)

(j) (i) Any ONE Of:

Volts
Voltage
EMF
V
E
U

(1 mark)

(ii) Any ONE Of:

Amp
Amperes
Current
A
I

(1 mark)

Question 2

(a) Any TWO of:

- To protect the fixed wiring against excess current flow
- Safely interrupt and disconnect a faulty circuit
- To detect overload
- To isolate the supply

(2 marks)

(b) Any **FIVE** 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.

(5 marks)

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

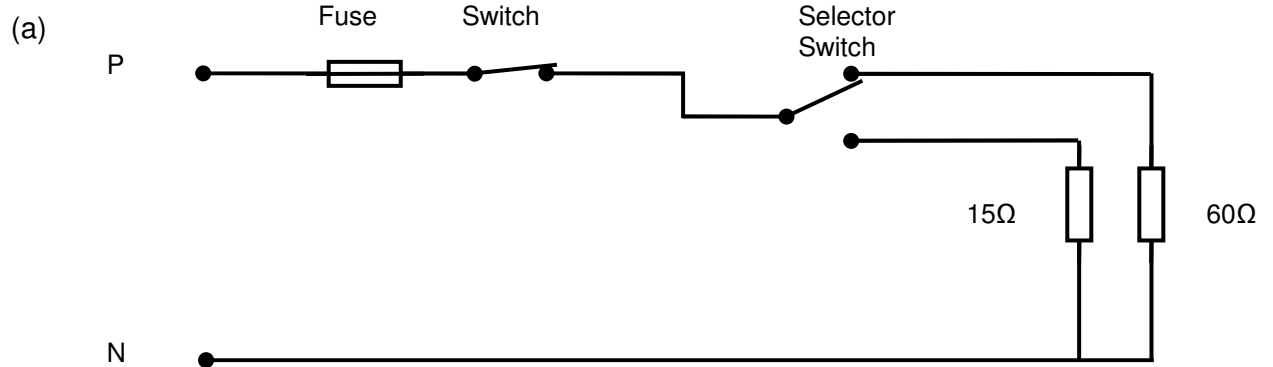
(2 marks)

(d) Any ONE of:

- To disconnect the circuit due to overload
- To disconnect a large fault current safely.
- To disconnect the circuit when a fault occurs

(1 mark)

Question 3



- Correct polarity (in the context of what is drawn). (1 mark)
- The fuse is in the phase and protects the whole circuit. (1 mark)
- The switch is in the phase and controls the whole circuit. (1 mark)
- The selector switch and resistors are connected so two different load settings can be achieved. (2 marks)

(b) (i) $I = \frac{V}{R}$ (1/2 mark)

$= \frac{230}{60}$ (1/2 mark)

$= 3.83 \text{ A}$ (1 mark)

(ii) $I = \frac{V}{R}$ (1/2 mark)

$= \frac{230}{15}$ (1/2 mark)

$= 15.33 \text{ A}$ (1 mark)

(iii) 16A is the most suitable fuse (1 mark)

Question 4

- (a) (i) • The high impedance of the voltmeter means the appliance will not operate. (1 mark)
- A reading of 230V is a reading of the supply voltage, not the voltage at the appliance. (1 mark)
- A 0V reading may indicate that the circuit is dead when it is not. (2 marks)
- (ii) The highest voltage range of the meter. (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) Any TWO of:
- Insulation must be tested to, at least, 500V voltage.
 - A standard multimeter or ohmmeter will not deliver the required voltage.
 - Will not subject the insulation to the same stress as the applied voltage.
 - Won't expose any weakness in the insulation resistance. (2 marks)

Section 2 - Plumbers Only

Question 5

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

$= \frac{2000}{230}$ (1/2 mark)

$= 8.7 \text{ amps}$ (1 mark)

The switch is adequate for the 2kW element. (1 mark)

- (b)
- Earth continuity resistance. AS/NZS 3760: 2.3.3.1
 - Insulation resistance. AS/NZS 3760: 2.3.3.2
 - Visual inspection AS/NZS 3760: 2.3.2 (3 marks)

- (c) Any FOUR of:
- Switch not damaged or burnt.
 - The flexible conduit is anchored at both ends and not damaged.
 - Conduit wire is in good condition and preferably high temp type.
 - Covers in place with no basic insulation or live terminals exposed to touch.
 - Cable terminations are tight.
 - Protective earthing conductor (earth continuity conductor) is connected to both the case and element frame.
- (4 marks)

or any FOUR from AS/NZS 3760: 2001: 2.3.2

- Check for obvious damage or defects in the accessories.
- Check that the inner cores of flexible supply cords are not exposed or twisted;
- Check that the external sheaths are not cut, abraded, twisted, or damaged to such an extent that the insulation of the inner cores is visible
- Check that unprotected conductors or insulation tape are not in evidence.
- Check that any controls are in good working order i.e. they are secure, aligned and appropriately identified.
- Check that covers, guards and the like are secured in the manner intended by the manufacturer or supplier.
- Check that safety facilities and devices are in good working order.
- Check that ventilation inlets and exhausts are unobstructed.

or

Any **FOUR** of – from AS/NZS 3760:2003:

- Check for obvious damage or defects in the accessories and for discolouration that may indicate exposure to heat, chemicals and moisture.
- Check that the inner cores of flexible supply cords are not exposed or twisted;
- Check that the external sheaths are not cut, abraded, twisted, or damaged to such an extent that the insulation of the inner cores is visible
- Check that unprotected conductors or banding insulation tape are not in evidence.
- Check that any operating controls are in good working order i.e. they are secure, aligned and appropriately identified.
- Check that covers, guards and the like are secured in the manner intended by the manufacturer or supplier.
- Check that ventilation inlets and exhausts are unobstructed.

Note: Candidates must give 4 different answers. They can come from any of the three alternatives above.

Question 6

- (a)
- 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)

(b) RCD

- To ensure the tripping mechanism has not become stuck or "frozen"
- or
- To ensure it works correctly

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.

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

$$= \frac{3000}{230}$$

(1/2 mark)

$$= 13A$$

(1/2 mark)

$$= 13A$$

(1 mark)

16 amp fuse (15 amp fuse is also acceptable) would be purchased. (1 mark)

- (d) To ensure that the replacement fuse link will safely interrupt the prospective short-circuit current level for that circuit. (2 marks)

Question 7

(a) (i) Three. (1 mark)

- (ii)
 - Red
 - Black
 - Green

or

- Brown
- Blue/Light Blue
- Green/yellow

(3 marks)

(b) (i) Two. (1 mark)

- (ii)
 - Phase (active) Brown or Red.
 - Neutral Blue/Light Blue or Black

(4 marks)

(c) Any ONE of:

- Minimise the risk of shock.
- Minimise the risk of short-circuit.

(1 mark)

Question 8

- (a)
- Turn off the circuit isolator and locate the MCB. (1 mark)
 - Affix a danger tag to the MCB. (1 mark)
 - Check for isolation at supply side of permanent connection unit using the prove-test-prove method. (2 marks)
 - Remove the flexible cord completely from the permanent connection unit and ensure that the cover of the connection unit is securely replaced. (1 mark)
- (b) Any TWO of:
- There may 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)
- (c) Any THREE 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. (3 marks)

Question 9

Circuit	Supply (Volts)	Total resistance (Ohms)	Current (Amps)	Power (Watts)
One	230	<i>23 ohms</i>	10	<i>2300 watts</i>
Two	200	<i>40 ohms</i>	<i>5 amps</i>	1000
Three	<i>230 volts</i>	46		1150

(a) Value 1

$$R = \frac{V}{I} \quad (1/2 \text{ mark})$$

$$= \frac{230}{10} \quad (1/2 \text{ mark})$$

$$= 23 \text{ ohms} \quad (1 \text{ mark})$$

(b) Value 2

$$W = V \times I \quad (1/2 \text{ mark})$$

$$= 230 \times 10 \quad (1/2 \text{ mark})$$

$$= 2300 \text{ watts (or 2.3 kW)} \quad (1 \text{ mark})$$

(c) Value 3

$$R = \frac{V}{I} \quad (1/2 \text{ mark})$$

$$= \frac{200}{5} \quad (1/2 \text{ mark})$$

$$= 40 \text{ ohms} \quad (1 \text{ mark})$$

or

$$R = \frac{V^2}{W}$$

(1/2 mark)

$$= \frac{200 \times 200}{1000}$$

(1/2 mark)

$$= 40 \text{ ohms}$$

(1 mark)

(d) Value 4

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

(1/2 mark)

$$= \frac{1000}{200}$$

(1/2 mark)

$$= 5 \text{ amps}$$

(1 mark)

(e) Value 5

$$V = \sqrt{W \times R}$$

(1/2 mark)

$$= \sqrt{46 \times 1150}$$

(1/2 mark)

$$= 230 \text{ volts}$$

(1 mark)

Section 3 – Gasfitters Only

Question 10

- (a) • With all control switches on: (1 mark)
- Join phase and neutral joined together to avoid damage to electronic components. (2 marks)
 - Test with a 500V insulation resistance tester from the appliance framework to phase and neutral (1 mark)
 - The result must not be less than 1 M Ω . (1 mark)
- (b) (i) Any ONE of:
- To ensure that the insulation will be able to withstand the applied voltage.
 - To ensure that the insulation resistance is not less than 1 M Ω (2 marks)
- (c) Any THREE of:
- Visual inspection
 - Correct circuit connections
 - Verification of polarity
 - Continuity of earthing (3 marks)

Question 11

- (a)
- 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)

(b) RCD

- To ensure the tripping mechanism has not become stuck or "frozen"
- or
- To ensure it works correctly

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)

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

$$= \frac{3000}{230}$$

(1/2 mark)

$$= 13A$$

(1 mark)

16 amp fuse (15 amp fuse is also acceptable) would be purchased. (1 mark)

- (d) To ensure that the replacement fuse link will safely interrupt the prospective short-circuit current level for that circuit. (2 marks)

Question 12

- (a)
- Turn off the circuit isolator and locate the MCB. (1 mark)
 - Affix a danger tag to the MCB. (1 mark)
 - Check for isolation at supply side of permanent connection unit using the prove-test-prove method. (2 marks)
 - Remove the flexible cord completely from the permanent connection unit and ensure that the cover of the connection unit is securely replaced. (1 mark)
- (b) Any TWO of:
- There may 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)
- (c) Any THREE 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. (3 marks)

Question 13

(a) (i) Three. (1 mark)

- (ii)
 - Red
 - Black
 - Green

or

- Brown
- Blue/Light Blue
- Green/yellow

(3 marks)

(b) (i) Two. (1 mark)

- (ii)
 - Phase (active) Brown or Red.
 - Neutral Blue/Light Blue or Black

(4 marks)

(c) Any ONE of:

- Minimise the risk of shock.
- Minimise the risk of short-circuit.

(1 mark)

Question 14

Circuit	Supply (Volts)	Total resistance (Ohms)	Current (Amps)	Power (Watts)
One	230	23 ohms	10	2300 watts
Two	200	40 ohms	5 amps	1000
Three	230 volts	46		1150

(a) Value 1

$$R = \frac{V}{I} \quad (1/2 \text{ mark})$$

$$= \frac{230}{10} \quad (1/2 \text{ mark})$$

$$= 23 \text{ ohms} \quad (1 \text{ mark})$$

(b) Value 2

$$W = V \times I \quad (1/2 \text{ mark})$$

$$= 230 \times 10 \quad (1/2 \text{ mark})$$

$$= 2300 \text{ watts (or 2.3 kW)} \quad (1 \text{ mark})$$

(c) Value 3

$$R = \frac{V}{I} \quad (1/2 \text{ mark})$$

$$= \frac{200}{5} \quad (1/2 \text{ mark})$$

$$= 40 \text{ ohms} \quad (1 \text{ mark})$$

or

$$R = \frac{V^2}{W}$$

(1/2 mark)

$$= \frac{200 \times 200}{1000}$$

(1/2 mark)

$$= 40 \text{ ohms}$$

(1 mark)

(d) Value 4

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

(1/2 mark)

$$= \frac{1000}{200}$$

(1/2 mark)

$$= 5 \text{ amps}$$

(1 mark)

(e) Value 5

$$V = \sqrt{W \times R}$$

(1/2 mark)

$$= \sqrt{46 \times 1150}$$

(1/2 mark)

$$= 230 \text{ volts}$$

(1 mark)