

TEWC 139 - 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) $R = \frac{V^2}{W}$ (1/2 mark)
- $= \frac{230 \times 230}{2300}$ (1/2 mark)
- $= 23 \Omega$ (1 mark)
- (b) The cross sectional area of the flexible cord conductors. (2 marks)
- (c) 500V d.c. (2 marks)
- (d) (i) Water, gas flow control, washing machine. (1 mark)
- (ii) Gas fires, cookers, clothes dryer, air compressor, pump, washing machine, dishwasher (1 mark)

- (e) Any TWO of:
- 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.
 - Use the prove-test-prove method
- (2 marks)
- (f) Any TWO of:
- Use a double insulated electric drill.
 - Connect the electricity supply to the drill through a residual current device.
 - Connect the electricity supply to the drill through an isolating transformer.
- (2 marks)
- (g) 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)
- (h) Closed circuit means a continuous conducting circuit from, and back to, the source of electricity.
- (2 marks)
- (i) (i) The section with the lowest resistance.
- (1 mark)
- (ii) The section with the highest resistance.
- (1 mark)
- (j) So that the transformer protects the extension leads as well as the portable appliance.
- (2 marks)

Question 2

- (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 loss of supply.

(1 mark)

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

(2 marks)

- (d)
- 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)

Question 3

(a) (i) 1 ohm.

(1 mark)

- (ii)
- The protective earthing conductor (earth continuity conductor) will ensure that if a phase to framework fault occurs, sufficient current will flow to ensure the rapid operation of the circuit protective device.
 - Exposed metal remains at earth potential if there is insufficient current to operate the circuit protective device.

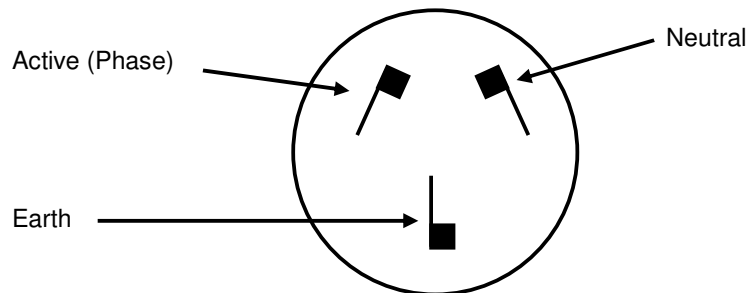
(2 marks)

(b) 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)

(c)



(3 marks)

(d) Any TWO of:

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

(2 marks)

Question 4

- (a) (i) • To ensure that the multimeter - even though indicating zero - is operating correctly. (1 mark)
- To ensure that the correct circuit has been isolated before it is worked on. (1 mark)
- (ii) • First - prove the meter is operating correctly on a known live circuit. (1 mark)
- Then - test that the isolated circuit shows no voltage present. (1 mark)
- Then - again prove the meter is operating correctly on a known live circuit. (1 mark)
- (b) (i) • 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)
- (ii) • 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)

Section 2 - Plumbers Only

Question 5

- (a) (i) • Utilisation category (fusing factor) is the ratio of minimum fusing current to the current rating of the fuse.
- alternatively this may be expressed as:
- Utilisation category (fusing factor) = $\frac{\text{Minimum Fusing Current}}{\text{Current Rating}}$ (2 marks)
- (ii) The lower the **Utilisation category (fusing factor)**, the less excess current is required to blow the fuse. (2 marks)
- (b) I = $\frac{W}{V}$ (½ mark)
- = $\frac{3000}{230}$ (½ mark)
- = 13A (1 mark)
- 16 amp fuse (15 amp fuse is also acceptable) would be purchased. (1 mark)
- (c) To ensure that the replacement fuse link will safely interrupt the prospective short-circuit current level for that circuit. (2 marks)
- (d) To disconnect a large fault current safely. (1 mark)

Question 6

- (a) 1. Identify the fuse on the switchboard for the appliance. (1 mark)
2. Switch off the main switch and remove fuse carrier. (1 mark)
- or
- Remove load from circuit and remove fuse carrier (1 mark)
3. Attach Danger tag to fuse base. (1 mark)
4. Test for isolation at the supply side of the permanent connect unit using the prove-test-prove method. (2 marks)

Note: 3 and 4 can be interchanged.

(b) Any FIVE of:

- Replace storage water cylinder heater elements that have an electrical rating of not more than 230 volts and 15 amperes; and
- Replace storage water cylinder thermostats that have an electrical rating of not more than 230 volts and 15 amperes; and
- Disconnect from and reconnect to fixed wiring waste disposal units that have an electrical rating of not more than 230 volts and 15 amperes:
- Disconnect from and reconnect to fixed wiring dishwashing units that have an electrical rating of not more than 230 volts and 15 amperes:
- Disconnect from and reconnect to fixed wiring electronic water control units that have an electrical rating of not more than 230 volts and 15 amperes:
- Disconnect from and reconnect to fixed wiring water pressure devices that have an electrical rating of not more than 230 volts and 15 amperes:
- Disconnect from and reconnect to fixed wiring storage water heater cylinders that have an electrical rating of not more than 230 volts and 15 amperes:
- Remove and replace fusible links in relation to plumbing work.

(5 marks)
ER 49(6)

Question 7

- (a) (i)
 - International Protection Codeor
 - Ingress Protectionor
 - 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 liquidsAS 1939 supplement 1 – 1990
(2 marks)

or

- A degree of protection in accordance with AS 1939.
AS/NZS 3000: 1.4.58

- (ii)
 - The degree of protection of persons against live or moving parts inside the enclosure
 - And protection of the fitting against ingress of solid foreign bodiesAS 1939 supplement 1 – 1990
(2 marks)

OR

- The degree of protection against solid objects
- Protection of persons against access to hazardous parts.
AS/NZS 3000: 1.4.58

OR

- Protection against solid objects
IEC 60529

- (iii)
 - Protection of equipment from the harmful ingress of waterAS 1939 supplement 1 – 1990
(2 marks)

OR

- Protection against the entry of water with harmful effects.
AS/NZS 3000: 1.4.58

OR

- Protection against liquids objects
IEC 60529

- (b) (i) Number 3
- Protection of persons holding tools or wires (larger than 2.5 mm diameter) and protection of equipment against objects larger than 1 mm

OR

- Protected against solid objects over 2.5 mm
IEC 60529
(1 mark)

(ii) Number 4

- Protection against splashing and spraying water from all practicable directions

OR

- Protected against water sprayed from all directions – limited ingress permitted

IEC 60529
(1 mark)

(c) A **damp situation** is a situation in which moisture is either permanently or intermittently present to such an extent as would be likely to impair the effectiveness or safety of an electrical installation.

(2 marks)

Question 8

- (a) AS/NZS 3760 (1 mark)
- (b) (i) (I) Low reading ohmmeter. (1 mark)
(II) 1 ohm maximum (1 mark)
- (ii) (I) Insulation resistance tester. (1 mark)
(II) 1 MΩ minimum (1 mark)
- (c) Any **FIVE** of – from AS/NZS 3760:2001:

- Check for obvious damage or defects in the accessories, connectors or plugs.
- Check that flexible cords are effectively anchored to equipment and plugs.
- Check for damage to flexible cords - the inner cores of flexible supply cords are not exposed or twisted;
- Check for damage to flexible cords the external sheaths are not cut, abraded, twisted, or damaged to such an extent that the insulation of the inner cores is visible; and (In) 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.

AS/NZS 3760: 2.3.2
(5 marks)

Or

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

- Check for obvious damage or defects in the accessories, connectors or plugs and for discolouration that may indicate exposure to heat, chemicals and moisture.
- Check that flexible cords are effectively anchored to equipment and plugs.
- Check for damage to flexible cords - the inner cores of flexible supply cords are not exposed or twisted;
- Check for damage to flexible cords - the external sheaths are not cut, abraded, twisted, or damaged to such an extent that the insulation of the inner cores is visible.
- Check for damage to flexible cords - 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.
- The pins of insulated pin plugs should be inspected for damage to the insulation of the pins, and, if fitted, the shroud on cord extension sockets.

AS/NZS 3760: 2.3.2
(5 marks)

Question 9

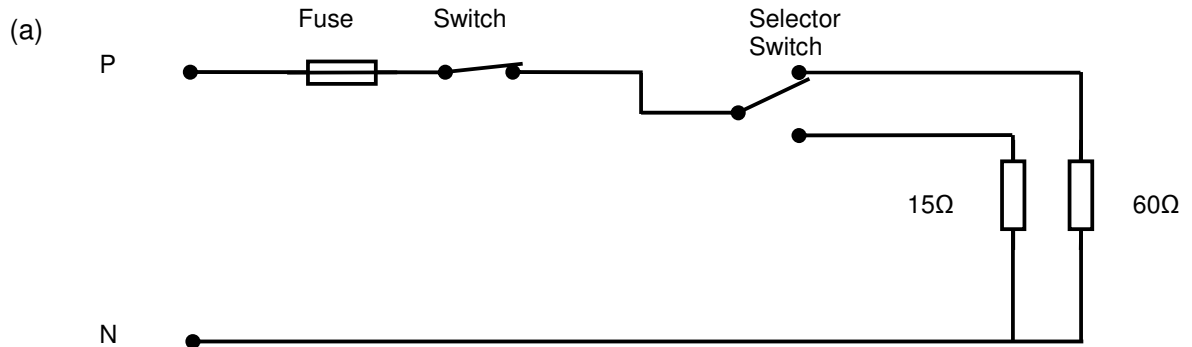
- (a) (i) It must be able to read accurately read values of 1 ohm or less (1 mark)
- (ii) • To check that the instrument is functional. (1 mark)
- Either of:
- To zero the meter for accuracy.
OR
- Compensate for the resistance of the leads. (1 mark)
- (iii) • It may show an apparent reading of zero. (1 mark)
- It may be inaccurate when the protective earthing conductor (earth continuity conductor) resistance is high. (1 mark)
- (b) • Use a low ohms continuity tester. (1 mark)
- Touch the leads together and adjust for zero. (1 mark)
- Test between the earth pin of the plug and and appliance. (1 mark)
- To obtain an accurate reading choose a point that will provide a good connection to earth i.e. free from paint, corrosion etc. (1 mark)
- Maximum acceptable value 1 ohm. (1 mark)

Section 3 – Gasfitters Only

Question 10

- (a) (i) • The motor will operate normally (1 mark)
- The motor circuitry could be live whilst switched off (1 mark)
- (ii) Any ONE of:
- The motor will operate normally (½ mark)
- The protective earthing conductor is the wrong colour – potential hazard. (½ mark)
- (iii) • The motor will not operate (1 mark)
- Its framework will be alive at 230V to earth
An immediate and serious shock hazard exists.
OR
Could operate the protective device (2 marks)
- (iv) Any ONE of:
- Earth continuity test
- Polarity test (1 mark)
- (b) Any THREE 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. (3 marks)

Question 11



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

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

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

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

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

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

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

Question 12

- (a) (i) • Utilisation category (fusing factor) is the ratio of minimum fusing current to the current rating of the fuse.

alternatively this may be expressed as:

- Utilisation category (fusing factor) = $\frac{\text{Minimum Fusing Current}}{\text{Current Rating}}$ (2 marks)

- (ii) The lower the **Utilisation category (fusing factor)**, the less excess current is required to blow the fuse. (2 marks)

(b) $I = \frac{W}{V}$ (½ mark)

$= \frac{3000}{230}$ (½ mark)

$= 13A$ (1 mark)

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

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

- (d) To disconnect a large fault current safely. (1 mark)

Question 13

- (a) AS/NZS 3760 (1 mark)
- (b) (i) (I) Low reading ohmmeter. (1 mark)
(II) 1 ohm maximum (1 mark)
- (ii) (I) Insulation resistance tester. (1 mark)
(II) 1 MΩ minimum (1 mark)
- (c) Any **FIVE** of – from AS/NZS 3760:2001:

- Check for obvious damage or defects in the accessories, connectors or plugs.
- Check that flexible cords are effectively anchored to equipment and plugs.
- Check for damage to flexible cords - the inner cores of flexible supply cords are not exposed or twisted;
- Check for damage to flexible cords the external sheaths are not cut, abraded, twisted, or damaged to such an extent that the insulation of the inner cores is visible; and (In) 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.

AS/NZS 3760: 2.3.2
(5 marks)

Or

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

- Check for obvious damage or defects in the accessories, connectors or plugs and for discolouration that may indicate exposure to heat, chemicals and moisture.
- Check that flexible cords are effectively anchored to equipment and plugs.
- Check for damage to flexible cords - the inner cores of flexible supply cords are not exposed or twisted;
- Check for damage to flexible cords - the external sheaths are not cut, abraded, twisted, or damaged to such an extent that the insulation of the inner cores is visible.
- Check for damage to flexible cords - 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.
- The pins of insulated pin plugs should be inspected for damage to the insulation of the pins, and, if fitted, the shroud on cord extension sockets.

AS/NZS 3760: 2.3.2

(5 marks)

Question 14

- (a)
- Use a 500V d.c. insulation tester. (1 mark)
 - Check meter's operation. (1 mark)
 - Test between the phase/neutral and accessible metal on the appliance. (1 mark)
 - Minimum acceptable value – $1\text{M}\Omega$. (1 mark)
- (b) Any ONE of:
- To ensure the insulation will not fail at its operating electrical voltage.
 - To verify that the insulation of current carrying components is capable of withstanding the normal supply voltage. (1 mark)
- (c)
- Replace fittings incorporated in gas-fired equipment that have an electrical rating of not more than 230 volts and 15 amperes; and
 - Disconnect from and reconnect to fixed wiring, fittings incorporated in gas-fired equipment that have an electrical rating of not more than 230 volts and 15 amperes; and
 - Remove and replace fusible links in relation to gasfitting work. (3 marks)
ER 49(7)
- (d) Any TWO of:
- Safe working practices.
 - Testing to ensure safety.
 - Basic first aid.
 - CPR. (2 marks)
ER 49(4)