

TEWC 145 - 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) Take a reading with a voltmeter between active and neutral and active and earth. (2 marks)
- (b) A double insulated appliance. (2 marks)
- (c) (i) Watts. (1 mark)
- (ii) Any ONE of:
- Active.
 - Line.
 - Live.
 - Alive.
 - Hot.
- (1 mark)
- (d) • Most of the internal wiring will be alive (1 mark)
- At 230V to earth with the switch in the "OFF" position. (1 mark)

(e) $I = \frac{P}{V}$ (1/2 mark)

$= \frac{1500}{240}$ (1/2 mark)

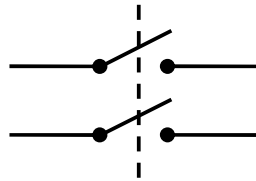
$= 6.25A$ (1 mark)

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



(1 mark)

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



(1 mark)

(g) Any TWO of:

- By the words "double insulation".
 - By the international symbol for double insulated equipment – a square within a square.
 - By the words "Class II".
- (2 marks)

(h) It is a continuous circuit that has a "break" in it. (2 marks)

- (i) Any ONE of:
- Ensure that the flexible cord is securely anchored
 - Ensure that the cord grip is on the sheath of the flexible cord, not on the basic insulation.
 - Ensure that the basic insulation exposed for the purpose of termination is kept to a minimum
- (2 marks)

(j) In respect of electricity supplied by either a single-phase MEN system or a multiple-phase MEN system, a nominal voltage of 230 volts a.c. between phase and neutral

ER 2
(2 marks)

Question 2

(a) Any ONE of:

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

(2 marks)

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

(2 marks)

- (c)
- Current rating.
 - Voltage rating.
 - Category of duty (Rupturing Capacity).
 - Utilisation category (fusing factor) (Class).

(4 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 3

- (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

Any ONE of:

- To ensure the trip mechanism operates.
- To ensure the RCD can detect a current imbalance and trip the RCD

or

PRCD

Any ONE of:

- To ensure the trip mechanism operates.
 - To ensure the RCD can detect a current imbalance and trip the RCD
 - To ensure PRCD does not remain in the "on" position after loss of supply.
- (1 mark)

(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.

(3 marks)

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

(2 marks)

Question 4

(a) Value 1

$$\begin{aligned} R &= \frac{V}{I} && \text{(1/2 mark)} \\ &= \frac{230}{10} && \text{(1/2 mark)} \\ &= 23 \text{ ohms} && \text{(1 mark)} \end{aligned}$$

(b) Value 2

$$\begin{aligned} W &= V \times I && \text{(1/2 mark)} \\ &= 230 \times 10 && \text{(1/2 mark)} \\ &= 2300 \text{ watts (or 2.3 kW)} && \text{(1 mark)} \end{aligned}$$

(c) Value 3

$$\begin{aligned} I &= \frac{W}{V} && \text{(1/2 mark)} \\ &= \frac{1000}{200} && \text{(1/2 mark)} \\ &= 5 \text{ amps} && \text{(1 mark)} \end{aligned}$$

(d) Value 4

$$\begin{aligned} R &= \frac{V}{I} && \text{(1/2 mark)} \\ &= \frac{200}{5} && \text{(1/2 mark)} \\ &= 40 \text{ ohms} && \text{(1 mark)} \end{aligned}$$

(e) Value 5

$$V = IR$$

(1/2 mark)

$$= 5 \times 46$$

(1/2 mark)

$$= 230 \text{ volts}$$

(1 mark)

OR

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

(1/2 mark)

$$= \frac{1150}{5}$$

(1/2 mark)

$$= 230 \text{ volts}$$

(1 mark)

Section 2 - Plumbers Only

Question 5

(a) Any **FOUR** of – from AS/NZS 3760:2001:

- Check for obvious damage or defects in the accessories or plugs.
- Check that flexible cords are effectively anchored to equipment and plugs.
- 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.

AS/NZS 3760: 2.3.2

(4 marks)

Or

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

- Check for obvious damage or defects in the accessories or plugs.
- Check for discolouration that may indicate exposure to heat, chemicals and moisture.
- Check that flexible cords are effectively anchored to equipment and plugs.
- 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.
- The pins of insulated pin plugs should be inspected for damage to the insulation of the pins.

AS/NZS 3760: 2.3.2

(4 marks)

(b) Test No.1

- (1) Protective earthing conductor (earth continuity) test
AS/NZS 3760: 2001: 2.3.3.1
AS/NZS 3760: 2003: 2.3.3.1
(1 mark)
- (2) Meter that can accurately read values of 1 ohm or less
(1 mark)
- (3) Maximum 1 ohm
AS/NZS 3760: 2001: 2.3.3.1
AS/NZS 3760: 2003: 2.3.3.1
(1 mark)

Test No.2

- (1) Insulation resistance test.
AS/NZS 3760: 2001: 2.3.3.2
(1 mark)
- (2) Insulation resistance tester
AS/NZS 3760: 2001: 2.3.3.2
AS/NZS 3760: 2001: 2.3.3.2(b)
(1 mark)
- (3) Not less than 1 Mohm
AS/NZS 3760: 2001: 2.3.3.2(a)
AS/NZS 3760: 2003: Table 2
(1 mark)

or

- (1) Insulation resistance test.
AS/NZS 3760: 2001: 2.3.3.2
AS/NZS 3760: 2003: 2.3.3.2
(1 mark)
- (2) Leakage current tester
AS/NZS 3760:2001: 2.3.3.2
(1 mark)
- (3) Not greater than 5mA
AS/NZS 3760: 2001: 2.3.3.2(a)
AS/NZS 3760: 2003: Table 1
(1 mark)

Question 6

(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) $P = V I$

(1/2 mark)

$$= 230 \times 4.84$$

(1/2 mark)

$$= 1113.2 \text{ W}$$

(1 mark)

(c) 6 A

(1 mark)

(d) 230 V

(1 mark)

Question 7

- (a) It is the maximum current that a flexible cord is designed to carry safely without overheating. (2 marks)
- (b) The insulation deteriorates and breaks down (2 marks)
- (c) Any FOUR of:
- Number of cores required
 - Mechanical strength
 - Operating environment
 - Flexibility needed
 - Application temperature at point of entry to appliance
 - Colour coding
 - Voltage rating
 - Current rating
 - Length
 - Cross-sectional area
- (4 marks)
- (d) • Minimise the risk of shock.
• Minimise the risk of short-circuit.. (2 marks)

Question 8

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

$= \frac{3000}{230}$ (1/2 mark)

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

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

- (b)
- 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?
 - Is the flexible cable capable of carrying the excess current?
- (3 marks)

(c) Any THREE of – from AS/NZS 3760:2001:

- Check for obvious damage or defects in the accessories or plugs.
- Check that flexible cords are effectively anchored to equipment and plugs.
- 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.

AS/NZS 3760: 2.3.2
(3 marks)

Or

Any THREE of – from AS/NZS 3760:2003:

- Check for obvious damage or defects in the accessories or plugs.
- Check for discolouration that may indicate exposure to heat, chemicals and moisture.
- Check that flexible cords are effectively anchored to equipment and plugs.
- 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.
- The pins of insulated pin plugs should be inspected for damage to the insulation of the pins.

AS/NZS 3760: 2.3.2
(3 marks)

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

(1 mark)

Question 9

- (a) 1. Identify the fuse on the switchboard for the appliance. (1 mark)
2. Switch off the main switch and remove fuse carrier.
- 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 connection unit using the prove-test-prove method. (2 marks)

(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)

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 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.
- (3 marks)

Question 11

- (a) (i) Three (1 marks)
- (ii) • Brown, light blue (or blue) and green/yellow
or
• Red, black, green (3 marks)
- (iii) Two (1 marks)
- (iv) • Brown and light blue (or blue)
or
• Red and 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. (1 mark)
- (ii) If all conductors are the same length, the earth may pull away first leaving the appliance operational but unearthed. (2 marks)

Question 12

(a) Any **FOUR** of – from AS/NZS 3760:2001:

- Check for obvious damage or defects in the accessories or plugs.
- Check that flexible cords are effectively anchored to equipment and plugs.
- 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.

AS/NZS 3760: 2.3.2

(4 marks)

Or

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

- Check for obvious damage or defects in the accessories or plugs.
- Check for discolouration that may indicate exposure to heat, chemicals and moisture.
- Check that flexible cords are effectively anchored to equipment and plugs.
- 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.
- The pins of insulated pin plugs should be inspected for damage to the insulation of the pins.

AS/NZS 3760: 2.3.2

(4 marks)

(b) Test No.1

- (1) Protective earthing conductor (earth continuity) test
AS/NZS 3760: 2001: 2.3.3.1
AS/NZS 3760: 2003: 2.3.3.1
(1 mark)
- (2) Meter that can accurately read values of 1 ohm or less
(1 mark)
- (3) Maximum 1 ohm
AS/NZS 3760: 2001: 2.3.3.1
AS/NZS 3760: 2003: 2.3.3.1
(1 mark)

Test No.2

- (1) Insulation resistance test.
AS/NZS 3760: 2001: 2.3.3.2
(1 mark)
- (2) Insulation resistance tester
AS/NZS 3760: 2001: 2.3.3.2
AS/NZS 3760: 2001: 2.3.3.2(b)
(1 mark)
- (3) Not less than 1 Mohm
AS/NZS 3760: 2001: 2.3.3.2(a)
AS/NZS 3760: 2003: Table 2
(1 mark)

or

- (1) Insulation resistance test.
AS/NZS 3760: 2001: 2.3.3.2
AS/NZS 3760: 2003: 2.3.3.2
(1 mark)
- (2) Leakage current tester
AS/NZS 3760:2001: 2.3.3.2
(1 mark)
- (3) Not greater than 5mA
AS/NZS 3760: 2001: 2.3.3.2(a)
AS/NZS 3760: 2003: Table 1
(1 mark)

Question 13

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

(2 marks)

(b) The insulation deteriorates and breaks down.

(2 marks)

(c) Any FOUR of:

- Number of cores required
- Mechanical strength
- Operating environment
- Flexibility needed
- Application temperature at point of entry to appliance
- Colour coding
- Voltage rating
- Current rating
- Length
- Cross-sectional area

(4 marks)

(d) • Minimise the risk of shock.
• Minimise the risk of short-circuit..

(2 marks)

Question 14

- (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 connection unit using the prove-test-prove method. (2 marks)
- (b) • Replace fittings incorporated in gas-fired equipment that have an electrical rating of not more than 230 volts and 15 amperes.
- 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.
- Remove and replace fusible links in relation to gasfitting work. (3 marks)
- (c) Any TWO of:
- Safe Working Practices
 - Testing
 - CPR
 - Basic first aid (2 marks)