

TEWC 149 - 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) Any TWO of:

- Prosecute the person.
- Disqualify or suspend the person for doing or assisting to do prescribed electrical work.
- Require a person to sit and pass any specified examination.
- Require a person to complete a period of training.
- Require a person to attend a specified course of instruction.
- Limit the work the person is permitted to do.
- Censure
- Make no order

EA 127
(2 marks)

(b) (i) 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

ER 2
(1 mark)

(ii) Means charged with electricity so that a difference in voltage exists to earth or between conductors

ER 2
(1 mark)

(c) 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)

(d) Any ONE of:

- An RCD
- An HRC fuse
- An MCB

(2 marks)

(e) $I = \frac{W}{V}$

(1/2 mark)

$$= \frac{1500}{230}$$

(1/2 mark)

$$= 6.52 \text{ A}$$

(1 mark)

(f) Any TWO of:

- Switch off the load.
- Hold face well back and averted when withdrawing/replacing the carrier.
- Wear safety glasses
- Withdraw, and replace, carrier with firm, fast action.

(2 marks)

(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) Any ONE of:

- To ensure the appliance is earthed prior to being livened.
- To ensure the appliance remains earthed until the supply is disconnected.

(2 marks)

(i) Any TWO of:

- Voltage applied.
- Current level .
- Contact duration.
- Skin dryness.
- Current path.

(2 marks)

(j) (i) 250V d.c.

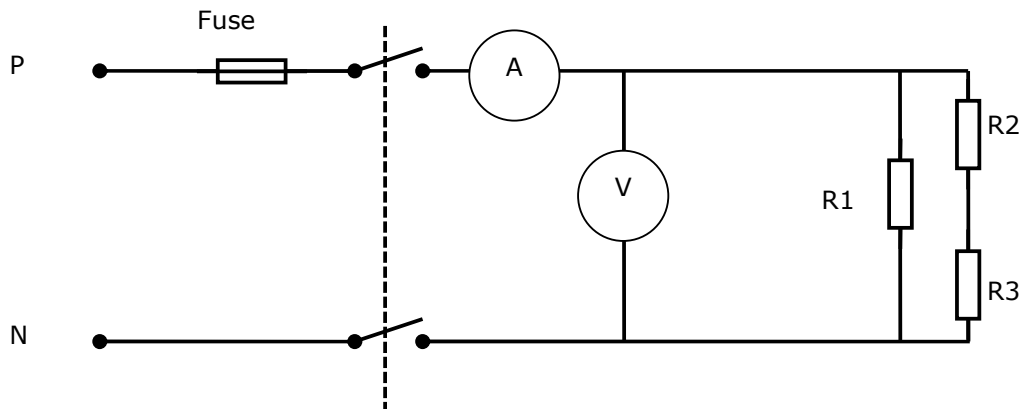
(1 mark)

(ii) 500V d.c.

(1 mark)

Question 2

(a)



- Correct polarity (1/2 mark)
- Correctly connected fuse (1/2 mark)
- Correctly connected switch (1/2 mark)
- Correctly connected voltmeter (1/2 mark)
- Correctly connected ammeter (1/2 mark)
- Correctly connected resistors. (1/2 mark)

(b) $\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2 + R_3}$ (1/2 mark)

$\frac{1}{R_p} = \frac{1}{30} + \frac{1}{50 + 40}$ (1/2 mark)

$\frac{1}{R_p} = \frac{1}{30} + \frac{1}{90}$ (1/2 mark)

$= \frac{4}{90}$ (1/2 mark)

$= 22.5\Omega$ (1 mark)

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

$$= \frac{230}{22.5} \quad (\frac{1}{2} \text{ mark})$$

$$= 10.22A \quad (1 \text{ mark})$$

$$(c) \quad W = V \times A \quad (\frac{1}{2} \text{ mark})$$

$$= 230 \times 10.22 \quad (\frac{1}{2} \text{ mark})$$

$$= 2350.6W \quad (1 \text{ mark})$$

Question 3

(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.
- Check that ventilation inlets and exhausts are unobstructed.

AS/NZS 3760: 2.3.2

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.
- 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
(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) Any ONE of:
- * Any meter that can accurately read values of less than 1Ω.
 - * An ohmmeter that is of Class 5 accuracy or better
- (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)

Question 4

(a) Any TWO of:

- There might 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)

(b) Any THREE of:

- To prevent basic insulation being exposed
- To prevent live terminals being exposed
- To prevent access to moving parts
- To prevent ingress of foreign matter or liquids

(3 marks)

(c) (i) Any THREE of:

- The flexible conduit has become detached exposing basic insulation.
- Broken isolating switch cover.
- There is no cover on the appliance terminals.
- Poor termination of cables

(3 marks)

(ii) Any TWO of:

- To prevent basic insulation from being exposed.
- To prevent the connections pulling away in the event of strain on the flexible cord.
- To prevent damage to cables.
- Double insulation is maintained

(2 marks)

Section 2 - Plumbers Only

Question 5

(a) (i) Any ONE of:

- 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
- Degrees of enclosure protection for electrical equipment
AS 60529
- A degree of protection in accordance with AS 1939.
AS/NZS 3000:2000 1.4.58
- A degree of protection in accordance with AS 60529
AS/NZS 3000:2007 1.4.61
(2 marks)

(ii) Any ONE of:

- 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
- Protection against solid objects
AS 60529
- The degree of protection against solid objects
- Protection of persons against access to hazardous parts.
AS/NZS 3000:2000: 1.4.58
- Protection against ingress of solid objects
AS/NZS 3000:2007: Figure G1a
(2 marks)

(iii) Any ONE of:

- Protection of equipment against harmful ingress of water.
AS 1939 supplement 1 – 1990
- Protection against liquids
AS 60529
- A degree of protection against entry of water with harmful effects.
AS/NZS 3000:2000 1.4.58
- Protection against harmful ingress of water
AS/NZS 3000:2007: Figure G1b
(2 marks)

(b) 2 Any ONE of:

- Protection of fingers against access to hazardous parts, and protection of equipment against objects larger than 12.5mm².
AS 1939 supplement 1
- Protected against solid objects over 12 mm e.g., fingers
AS 60529
- Full penetration of 1.5mm diameter sphere not allowed. The jointed test finger shall have adequate clearance from hazardous parts.

AS/NZS 3000:2007: Figure G1a
(1 mark)

3 Any ONE of:

- Protection against spraying water at up to 60° from the vertical.
AS 1939 supplement 1
- Protected against sprays to 60° from the vertical
AS 60529
- Protected against sprays to 60° from the vertical. Limited ingress permitted.

AS/NZS 3000:2007: Figure G1b
(1 mark)

(c) Any ONE of:

- They do not offer protection against the ingress of moisture which could result in a hazard of electric shock
- Electrical appliances that do not have personal electrical protection such as an RCD
- Electrical appliances that are not supplied by an individual isolating transformer.
- Electrical appliances that are not supplied at extra low voltage from an individual transformer.

ER 90
(2 marks)

Question 6

- (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) Any ONE of:

- The lower the Utilisation category (fusing factor), less current is required to blow the fuse.
- The higher the Utilisation category (fusing factor), more 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 7

(a)

PEC	Green	Green/yellow
Neutral	Black	Light blue or blue
Active (phase)	Red	Brown

Note: If the colours in the columns are mixed, the answer is incorrect
(3 marks)

- (b)
- Minimise the risk of shock.
 - Minimise the risk of short-circuit.
- (2 marks)

(c) Any TWO 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)

- (d) If strain is applied to the flexible cord the protective earthing conductor will be the last to pull away from the terminals thereby ensuring the appliance remains earthed

(2 marks)

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

(1 mark)

Question 8

(a) The procedure has to cover:

- The control switches turned on: (1 mark)
- Bridging the active (phase) and neutral conductors. (1 mark)
- Use of an insulation resistance tester. (1 mark)
- Testing between the bridged active (phase) and neutral and the appliance frame. (1 mark)
- The result must not be less than 1 M Ω . (1 mark)

(b) To ensure that the insulation will be able to withstand the applied voltage without failure.

(2 marks)

(c) Any THREE of:

- Visual inspection
- Continuity of conductors
- Continuity of earthing
- Correct circuit connections (polarity)

(3 marks)

Question 9

- (a) The transformer protects the extension lead and the handheld electrical appliance. (2 marks)
- (b) (i) No voltage can exist between either of the secondary terminals and earth. (1 mark)
- (ii) A fault to earth on both appliances at the same time could result in a 230 volt potential between appliances. (2 marks)
- (c) (i)
 - That the test instrument functions correctly.
 - That the circuit to be worked on has been correctly isolated and is safe to work on. (2 marks)
- (ii)
 - Check that test instrument works correctly on a known live source. (1 mark)
 - Test for isolation (between all conductors) on the circuit being isolated. (1 mark)
 - Check again that test instrument works correctly on a known live source. (1 mark)

Section 3 – Gasfitters Only

Question 10

(a) (i) The method has to show:

- Identification of the fuse on the switchboard for the boiler. (1 mark)
- Removing the load from circuit and removing fuse carrier (1 mark)
- Testing for isolation at the supply side of the permanent connect unit using the prove-test-prove method. (2 marks)

(ii) The method has to show:

- Identification of the correct fuse on the switchboard by a process of elimination. (1 mark)
- Re-testing for isolation at the supply side of the permanent connect unit using the prove-test-prove method. (2 marks)
- Attaching a danger tag to the fuses. (1 mark)

(b) • Ensure the permanent connection unit cover is securely fixed in place to prevent access to live parts. (2 marks)

Question 11

- (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) Any ONE of:

- The lower the Utilisation category (fusing factor), less current is required to blow the fuse.
- The higher the Utilisation category (fusing factor), more current is required to blow the fuse.

(2 marks)

(b) 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)

- (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 12

(a)

PEC	Green	Green/yellow
Neutral	Black	Light blue or blue
Active (phase)	Red	Brown

Note: If the colours in the columns are mixed, the answer is incorrect
(3 marks)

- (b)
- Minimise the risk of shock.
 - Minimise the risk of short-circuit.
- (2 marks)

(c) Any TWO 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)

- (d) If strain is applied to the flexible cord the protective earthing conductor will be the last to pull away from the terminals thereby ensuring the appliance remains earthed

(2 marks)

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

(1 mark)

Question 13

(a) The procedure has to cover:

- The control switches turned on: (1 mark)
- Bridging the active (phase) and neutral conductors. (1 mark)
- Use of an insulation resistance tester. (1 mark)
- Testing between the bridged active (phase) and neutral and the appliance frame. (1 mark)
- The result must not be less than 1 M Ω . (1 mark)

(b) To ensure that the insulation will be able to withstand the applied voltage without failure. (2 marks)

(c) Any THREE of:

- Visual inspection
- Continuity of conductors
- Continuity of earthing
- Correct circuit connections (polarity)

(3 marks)

Question 14

- (a) The transformer protects the extension lead and the handheld electrical appliance. (2 marks)
- (b) (i) No voltage can exist between either of the secondary terminals and earth. (1 mark)
- (ii) A fault to earth on both appliances at the same time could result in a 230 volt potential between appliances. (2 marks)
- (c) (i)
 - That the test instrument functions correctly.
 - That the circuit to be worked on has been correctly isolated and is safe to work on. (2 marks)
- (ii)
 - Check that test instrument works correctly on a known live source. (1 mark)
 - Test for isolation (between all conductors) on the circuit being isolated. (1 mark)
 - Check again that test instrument works correctly on a known live source. (1 mark)