

TEWC 153 - 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) (i) Power or Watts (1 mark)
- (ii) Current or Amp or amperes. (1 mark)
- (b) (i) 250V d.c. (1 mark)
- (ii) 500V d.c. (1 mark)
- (c) Any TWO 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.
- (2 marks)
- (d) Take a reading with a voltmeter between active and neutral and active and earth. (2 marks)

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

(f) • Safe working practices that are appropriate to the type of work being undertaken.
• Testing to ensure safety before, during and after work. ER 26(2)(a) & (b) (2 marks)

(g) It will provide protection for the extension leads between the transformer and the appliance. (2 marks)

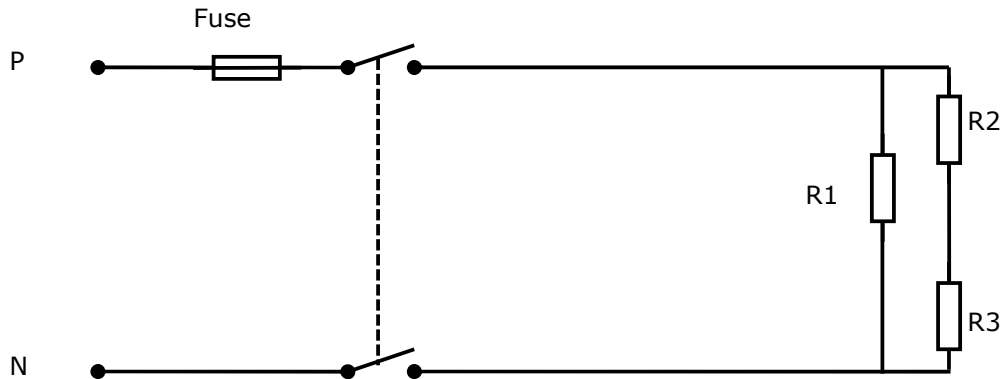
(h) Any TWO of:
• Damage to the circuit wiring.
• Overheating or fire hazard.
• Shock hazard (2 marks)

(i) $R = \frac{V^2}{W}$ (1/2 mark)
 $= \frac{230 \times 230}{1500}$ (1/2 mark)
 $= 35.27\Omega$ (1 mark)

(j) ONE of:
• The words "double insulation" on the appliance nameplate.
• The symbol "square within a square" on the appliance nameplate.
• The words "Class II" on the appliance nameplate. (2 marks)

Question 2

(a)



- Correct polarity (1/2 mark)
- Correctly connected fuse (1/2 mark)
- Correctly connected switch (1/2 mark)
- Correctly connected resistors. (1/2 mark)
- Working circuit (1 mark)

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

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

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

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

$$= 22.5\Omega \quad (1 \text{ mark})$$

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

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

$$= 10.22A$$

$$\begin{aligned} \text{(c) } W &= V \times A \\ &= 230 \times 10.22 \\ &= 2350.6W \end{aligned}$$

(1 mark)

(½ mark)

(½ mark)

(1 mark)

Question 3

- (a) • Protective earthing conductor test (½ mark)
- An ohmmeter
or
Any meter that can accurately read values of less than 1Ω . (½ mark)
 - 1Ω (½ mark)
 - Maximum (½ mark)
AS/NZS 3760: 2001: 2.3.3.1
AS/NZS 3760: 2003: 2.3.3.1
- Insulation resistance test (½ mark)
- Insulation resistance tester (½ mark)
 - 500 V d.c. (1 mark)
 - $1\text{ M}\Omega$ (½ mark)
 - Minimum (½ mark)
AS/NZS 3760: 2001: 2.3.3.2
AS/NZS 3760: 2003: 2.3.3.2, Table
- (b) • Not less than $1\text{ M}\Omega$ (½ mark)
- AS/NZS 3760: 2001: 2.3.3.3 or Appendix C3
Or
AS/NZS 3760: 2003: 2.3.3.3 (½ mark)
- (c) • To ensure that the control switch switches the active conductor.
• The active pin on the plug is connected to the active terminal in the appliance
• The neutral pin on the plug is connected to the neutral terminal in the appliance
• That only the earth pin on the plug is connected to the frame of the appliance. (4 marks)

Question 4

(a) Any FOUR of:

- Select the correct types of and rating of the instruments required.
- Inspect instrument, clips, leads and probes to ensure they are in good condition.
- Ensure correct range is selected on the instrument.
- Ensure leads are correctly connected.
- Prove that the meter works on a known live source.

(4 marks)

(b) (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)

(c) Any ONE of:

- To ensure an isolated circuit remains isolated until the person who attached the tag changes the status of the circuit.
- To warn against interference by any person who may attempt to liven the circuit

(1 mark)

Section 2 - Plumbers Only

Question 5

(a) (i) Any ONE of:

- To ensure that the resistance of the protective earthing conductor is not greater than 1 ohm.
- To ensure that the earthing systems has been installed in a manner that will cause circuit protective devices to operate if there is a fault between live parts, other than the neutral, and the mass of earth.

(1 mark)

(ii) Any ONE of:

- To ensure that the insulation resistance between active and earth, active and neutral and neutral and earth Is not less than 10,000 ohms.
- To ensure that the insulation resistance between all live conductors and earth and all live parts and earth is adequate.

(2 marks)

(iii) Any ONE of:

- To ensure phase conductor is terminated at the phase terminal
To ensure neutral conductor is terminated at the neutral terminal
To ensure the thermostat switches the phase conductor.
To ensure the protective earthing conductor is connect to the frame of the cylinder.
- To ensure protective earthing conductors do not normally carry current.
To ensure no short circuit exists
To ensure no exposed conductive parts become energised.
To prevent the connection of switches in neutral conductors.

(4 marks)

(b) • The supply would be short-circuited.

(2 marks)

• If the meter protection did not operate:

A personal hazard – flash burns.

or

Meter and/or appliance components could be damaged.

(1 mark)

Question 6

(a) The procedure has to cover:

- Identifying the correct fuse on the switchboard. (1 mark)
- Attaching a Danger tag to the circuit. (1 mark)
- Removing the isolator cover and testing for voltage at the supply side of the isolator using the prove-test-prove method. (2 marks)

(b) The description has to cover:

1. A protective earthing conductor test showing: (½ mark)
 - the use of a meter that can accurately read values of 1 ohm or less (½ mark)
 - a testing between the PEC conductor of the flexible cord and the case of the cylinder (½ mark)
 - an expected test result of 1 ohm (½ mark)
 - the test result being a maximum value (½ mark)
2. An insulation resistance test showing: (½ mark)
 - the use of an insulation resistance tester (½ mark)
 - a 500V d.c. test voltage (½ mark)
 - testing between phase and earth and neutral and earth (½ mark)
 - an expected test result of 10,000 ohms or 0.01 Mohms (1 mark)
 - the test result being a minimum value (½ mark)

Question 7

(a) Set 1

Brown	Phase	(1 mark)
Blue	Neutral	(1 mark)
Green or Green/Yellow	Earth	(1 mark)

Set 2

Red	Phase	(1 mark)
Black	Neutral	(1 mark)
Green	Earth	(1 mark)

- (b) • Fully unwind the cord from the drum
or
Partially unwind the cord to ensure the current rating is not exceeded when the cord is in use.
• Ensure that load is less than the current carrying capacity of the cord, when the cord is wound on the drum
(2 marks)
- (c) The current rating of the cord.
(1 mark)
- (d) Voltage is dropped as the load current passes through the conductor resistance
(1 mark)

Question 8

- (a) (i) • To protect the fixed wiring against excess current flow
or
• Safely interrupt and disconnect a faulty circuit (2 marks)
- (ii) To protect against earth leakage current in the circuit. (2 marks)
- (b) 45A Is the maximum current the fuse can continuously carry (1/2 mark)
without deterioration. (1/2 mark)
- 415V is the maximum voltage the fuse can withstand (1/2 mark)
without flashover. (1/2 mark)
- AC40 40,000AC is the maximum prospective short circuit current (1/2 mark)
the fuse can safely interrupt (1/2 mark)
- (c) Any TWO of:
- It prevents the fuse element from bulging out the side of the carrier and being accessible to touch.
 - Under overload conditions the heat produced in the element is confined to the tunnel area.
 - Under short-circuit conditions the arc and molten element is confined within the fuse carrier and base.
- (2 marks)
- (d) To disconnect a large fault current safely. (1 mark)

Question 9

(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
- A degree of protection of an item of enclosed equipment is expressed as an IP (International Protection) rating in accordance with AS 60529.
AS/NZS 3000:2007: G1
(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 of against ingress of solid objects.
AS/NZS 3000:2007: Table G1(a)
(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 of against harmful ingress of water.
AS/NZS 3000:2007: Table G1(b)
(2 marks)

(b) **3** Any ONE of:

- Protection of persons holding tools or wires (larger than 2.5 mm) and protection of equipment against objects larger than 2.5mm².
AS 1939 supplement 1

- Protected against solid objects over 2.5 mm (tools and small wires)
AS 60529
- The access probe of 2.5 mm diameter shall not penetrate.
AS/NZS 3000:2007: Table G1(a)
(1 mark)

4 Any ONE of:

- Protection against splashing and spraying water from all practicable directions.
AS 1939 supplement 1
- Protection against water sprayed from all directions – limited ingress permitted.
AS 60529
- Protection against water splashed from all directions. Limited ingress permitted.
AS/NZS 3000:2007: Table G1(b)
(1 mark)

(c) A situation in which moisture is either permanently present, or intermittently present to such an extent as would be likely to impair the effectiveness or safety of an electrical installation which complies with this Standard for ordinary situations.

AS/NZS 3000:2000 1.4.37
AS/NZS 3000:2007 1.4.40
(2 marks)

Section 3 – Gasfitters Only

Question 10

- Carry out the protective earthing conductor test first. (1 mark)
To ensure that the protective earthing conductor resistance is low (or 1 ohm or below) so no false insulation resistance test reading is obtained. (2 marks)
- Protective earthing conductor test
 - Use an instrument that can read values of less than 1 ohm (1 mark)
 - Test between the end of the screen and the frame of the appliance (1 mark)
 - The acceptable test result is 1 ohm - maximum. (1 mark)
- Insulation resistance test
 - Use an insulation resistance tester (1 mark)
 - A test voltage of 500v d.c. (1 mark)
 - Test between phase/neutral and earth (1 mark)
 - The acceptable test result is 1 M Ω , minimum (1 mark)

Question 11

(a) The procedure has to cover:

- Identifying the correct fuse on the switchboard. (1 mark)
- Attaching a Danger tag to the circuit. (1 mark)
- Removing the isolator cover and testing for voltage at the supply side of the isolator using the prove-test-prove method. (2 marks)

(b) The description has to cover:

1. A protective earthing conductor test showing: (½ mark)
 - the use of a meter that can accurately read values of 1 ohm or less (½ mark)
 - a testing between the PEC conductor of the flexible cord and the case of the cylinder (½ mark)
 - an expected test result of 1 ohm (½ mark)
 - the test result being a maximum value (½ mark)
2. An insulation resistance test showing: (½ mark)
 - the use of an insulation resistance tester (½ mark)
 - a 500V d.c. test voltage (½ mark)
 - testing between phase and earth and neutral and earth (½ mark)
 - an expected test result of 10,000 ohms or 0.01 Mohms (1 mark)
 - the test result being a minimum value (½ mark)

Question 12

(a) Set 1

Brown	Phase	(1 mark)
Blue	Neutral	(1 mark)
Green or Green/Yellow	Earth	(1 mark)

Set 2

Red	Phase	(1 mark)
Black	Neutral	(1 mark)
Green	Earth	(1 mark)

- (b) • Fully unwind the cord from the drum
or
Partially unwind the cord to ensure the current rating is not exceeded when the cord is in use.
• Ensure that load is less than the current carrying capacity of the cord, when the cord is wound on the drum
(2 marks)
- (c) The current rating of the cord.
(1 mark)
- (d) Voltage is dropped as the load current passes through the conductor resistance
(1 mark)

Question 13

- (a) (i) • To protect the fixed wiring against excess current flow
or
• Safely interrupt and disconnect a faulty circuit (2 marks)
- (ii) To protect against earth leakage current in the circuit. (2 marks)
- (b) 45A Is the maximum current the fuse can continuously carry (1/2 mark)
without deterioration. (1/2 mark)
- 415V is the maximum voltage the fuse can withstand (1/2 mark)
without flashover. (1/2 mark)
- AC40 40,000AC is the maximum prospective short circuit current (1/2 mark)
the fuse can safely interrupt (1/2 mark)
- (c) Any TWO of:
- It prevents the fuse element from bulging out the side of the carrier and being accessible to touch.
 - Under overload conditions the heat produced in the element is confined to the tunnel area.
 - Under short-circuit conditions the arc and molten element is confined within the fuse carrier and base.
- (2 marks)
- (d) To disconnect a large fault current safely. (1 mark)

Question 14

(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.
- Poor termination of cables
- Cables overheating

(3 marks)

(b) Any TWO of:

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

(2 marks)

- (c) • There would be exposed live terminals in the fuse base.
• The circuit can be easily relivened by inserting another fuse carrier in the fuse.

(2 marks)

(d) Any THREE of:

- To prevent basic insulation being exposed
- To prevent live terminals being exposed
- To prevent access to moving parts
- The fitting will not comply with its IP rating

(3 marks)