

# TRADESPERSONS ELECTRICAL WORK CERTIFICATE 132 - MARKING SCHEDULE

Note: (1 mark) means that the preceding statement earns 1 mark.

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.

## Section 1 – All Candidates

### Question 1

(a) Open circuit means a normally complete continuous circuit that is disconnected or switched "off".  
(2 marks)

(b) 
$$\begin{aligned} R &= \frac{V^2}{W} \\ &= \frac{230 \times 230}{2300} \\ &= 23 \Omega \end{aligned}$$
  
(2 marks)

(c) Any TWO of:

- \* To prevent an arc from developing between the terminals when the fuse blows.
  - \* It also ensures that the fuse element "blows" where required by concentrating heat in that area.
  - \* Contain the arc against splattering outside of the covered section.
  - \* To ensure no bare wires can be touched.
- (2 marks)

(d) Any TWO of:

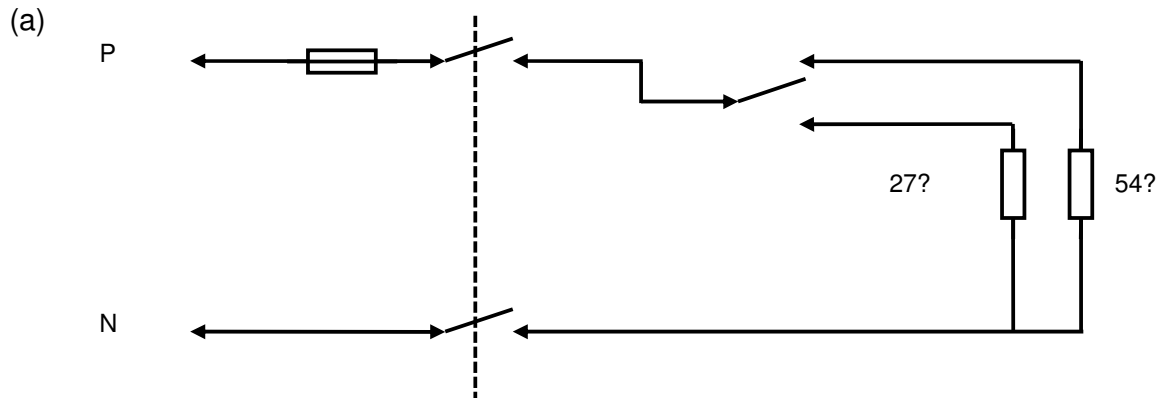
- If the fuse blows again an arc may be established between the fuse terminals causing damage or injury
  - Fuse wire does not have the same Utilisation category (fusing factor) as the HRC fuse
  - Cannot safely interrupt short circuit currents of much higher values.
  - Fuse wire may protrude past the holder which creates an exposure to shock.
  - Suitable fixing for the fuse wire is not generally available.
  - Fuse holder is not fire proof.
  - Cannot provide "close" protection.
  - Cannot ensure reliable operation within prescribed limits.
  - Poor discrimination.
  - Fusing characteristics not constant.
  - Slower operation/acting.
  - Deteriorates over time.
- (2 marks)

- (e) (i) Water, gas flow control, washing machine. (1 mark)
- (ii) Gas fires, cookers, clothes dryer, air compressor, pump. (1 mark)

## Question 2

- (a) A thermostat has contacts that open or close when the load reaches the pre-determined temperature setting. (2 marks)
- (b) Any TWO of:
- Length of cord
  - Cross-sectional area
  - Number of cores
  - Type of insulation or sheath
  - Colour code for connection
- (2 marks)
- (c) Any TWO of:
- \* 500V insulation resistance test.
  - \* Polarity test.
  - \* Protective earthing conductor (earth continuity conductor) resistance.
  - \* Circuit continuity test.
- (2 marks)
- (d) \*
- 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 a safe earth potential to prevent harm if there is insufficient current to operate the circuit protective device.
- (2 marks)
- (e) (i) To disconnect a large fault current safely. (1 mark)
- (ii) An isolating transformer (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 double pole 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) 
$$I = \frac{V}{R}$$

$$= \frac{230}{27}$$

$$= 8.5A$$
(2 marks)

(ii) 10A is the most suitable fuse (1 mark)

(c) 
$$W = \frac{V^2}{R}$$

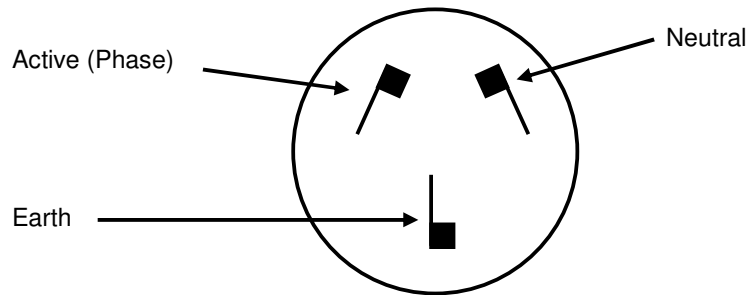
$$= \frac{230 \times 230}{54}$$

$$= 979.6 W$$
(2 marks)

#### Question 4

- (a) 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)

(b)



(3 marks)

#### Question 5

Table 3.5 of AS/NZS 3000

<b>COLOURS OF CABLE CORES</b>		
<b>Function</b>	<b>Identifying colours</b>	
	<b>Recommended</b>	<b>Alternative</b>
Earth/bonding	<b><i>Green/yellow</i></b>	<b><i>Green</i></b>
Neutral	<b><i>Black</i></b>	<b><i>Light blue</i></b>
Active	Red	<b><i>Any colour except green/yellow, green, black, light blue</i></b>

Note: No marks if not completely correct.  
 A later amendment to AS/NZS 3000 permits the use of yellow as an active conductor in NZ.

### Question 6

- \* Check the test instrument on a known live source. This proves that the meter is working correctly. (2 marks)
- \* Test for isolation (between all conductors) on the circuit being isolated. (1 mark)
- \* Re-check the test instrument on the known live source. This ensures that it is working correctly. (2 marks)

### Question 7

- (a)
- \* Turn off the circuit isolator and locate the correct fuse or MCB. (1 mark)
  - \* Remove fuse carrier or turn off MCB and affix a danger tag. (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)
  - \* Replace the danger tag with an out of service tag. (1 mark)
- (b) Any TWO of:
- \* There would 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 TWO 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. (2 marks)

## Question 8

- (a) (i) All equipment shall be visually inspected and physically checked in accordance with Clause 2.3.2

AS/NZS 3760:2001 : 2.3.1

or

An external inspection of the equipment and connecting facilities (e.g., supply flexible cord)

AS/NZS 3760:2001 : 2.3.1(a)  
(2 marks)

- (ii) Test: Protective earthing conductor (earth continuity) test  
AS/NZS 3760: 2001: 2.3.3.1  
AS/NZS 3760: 2003: 2.3.3.1  
(½ mark)

Instrument: Low reading ohmmeter or any instrument incorporating a low ohms scale

GK  
(½ mark)

Result Maximum 1 ohm

AS/NZS 3760: 2001: 2.3.3.1  
AS/NZS 3760: 2003: 2.3.3.1  
(1 mark)

Test Insulation resistance test.

AS/NZS 3760: 2001: 2.3.3.2  
AS/NZS 3760: 2003: 2.3.3.2  
(½ mark)

Instrument 500V d.c insulation resistance tester

AS/NZS 3760: 2001: 2.3.3.2  
AS/NZS 3760: 2001: 2.3.3.2(b)  
(½ mark)

Result Not less than 1 Mohm

AS/NZS 3760: 2001: 2.3.3.2(a)  
AS/NZS 3760: 2003: Table 2  
(1 mark)

or

Instrument 250V d.c insulation resistance tester

AS/NZS 3760: 2001: 1.1(e)(Note 3) Warning  
AS/NZS 3760:2003: 2.3.3.2(b)  
(½ mark)

Result Not less than 1 Mohm

AS/NZS 3760: 2001: 2.3.3.2(a)  
AS/NZS 3760: 2003: Table 2

(1 mark)

or  
Instrument                      Leakage current tester  
AS/NZS 3760:2001: 2.3.3.2  
(½ mark)

Result                      Not greater than 5mA  
AS/NZS 3760: 2001: 2.3.3.2(a)  
AS/NZS 3760: 2003: Table 1  
(1 mark)

(b) (1) Withdrawn from service immediately, have a label attached to it warning against further use; and

(2) Sent for repair, disposal or destruction by an authorized repair agent or service personnel.

AS/NZS 3760: 2001: 2.4.1

Or

(1) Where in-service inspection or testing identifies equipment which fails to comply with the criteria given in this Standard, the equipment shall be appropriately labelled to indicate that the equipment requires remedial action and warn against future use.

(2) The choice of remedial action, disposal or other corrective action shall be determined by the owner or the person responsible for the safety of the site.

AS/NZS 3760: 2003: 2.4.1  
(2 marks)

(c) An insulation resistance tester set to the 500V range will not provide an accurate measurement for values lower than 0.5 MΩ.

(2 marks)

### Question 9

- (a) (i) 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  
(1 mark)

OR

A degree of protection in accordance with AS 1939.  
AS/NZS 3000: 1.4.58  
(1 mark)

- (ii) “5” means – Protection against entry of dust in sufficient quantities to interfere with the satisfactory operation of equipment.  
AS 1939 supplement 1  
(1 mark)

- (iii) “6” means – Protection against heavy seas or a strong jet of water from all practicable directions  
. AS 1939 supplement 1  
(1 mark)

- (b) A **damp situation** is a situation in which moisture is either permanently or intermittently present to such an extent as would be likely impair the effectiveness or safety of an electrical installation.  
(2 marks)  
AS/NZS 3000: 1.4.37

## Section 2 – Plumbers and Plumber/Gasfitters Only

### Question 10

(a)  $I = \frac{W}{V}$   
 $= \frac{2000}{230}$  (1 mark)  
 $= 8.69 \text{ amps}$  (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 contact.
  - \* 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, connectors, plugs or extension outlet sockets.
- \* Check that flexible cords are effectively anchored to equipment, plugs and cord extension sockets.
- \* Check for damage to flexible cords -
  - the inner cores of flexible supply cords are not exposed or twisted;
  - 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.

- \* For portable outlet devices, check that the warning indicating the maximum load to be connected to the device is intact and legible.
- \* 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, connectors, plugs or extension outlet sockets; and for discolouration that may indicate exposure to heat, chemicals and moisture.
- \* Check that flexible cords are effectively anchored to equipment, plugs and cord extension sockets.
- \* Check for damage to flexible cords -
  - (i) the inner cores of flexible supply cords are not exposed or twisted;
  - (ii) the external sheaths are not cut, abraded, twisted, or damaged to such an extent that the insulation of the inner cores is visible.
  - (iii) unprotected conductors or banding insulation tape are not in evidence.
- \* For portable outlet devices (power boards), check that the warning indicating the maximum load to be connected to the device is intact and legible.
- \* 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.

## Question 11

- (a) (i) A situation wherein there is a reasonable chance of a person touching exposed conductive parts and, at the same time, coming into contact with earth or with any conducting medium which may be in electrical contact with the earth or through which a circuit may be completed to earth.

(3 marks)

AS/NZS 3000: 1.4.41

- (ii) Any ONE of:

- \* Within 2.5 m in any direction from a conductive floor (such as earthen, concrete, tile or brickwork flooring), permanently damp surface, metallic conduit or pipe, metallic cable sheath or armour or any other conductive material on which a person may stand.
- \* External to a building, except for an isolated piece of equipment such as switchgear or a luminaire which is mounted more than 2.5 m from the ground and from any exposed conductive part or other conductive material which is in contact with earth.
- \* Within 2.5 m of the ground, floor or platform in rooms containing socket-outlets, the earthing terminals of which are earthed, and where there is a reasonable chance of a person making simultaneous contact with any exposed conductive part of electrical equipment and any exposed conductive part of an appliance connected to any of the socket-outlets.
- \* All parts of a bathroom, laundry, lavatory, toilet or kitchen.

(2 marks)

AS/NZS 3000: 1.4.41

- (b) (i) Bridge the section of galvanised pipe with a jumper lead. (1 mark)

- (ii) Any earth current flowing will pass through the jumper lead rather than set up a potential shock situation. (1 mark)

- (c) \*
- \* Advise the owner that the earth lead will be effectively disconnected or some bonding will become ineffective when the pipe is cut.
  - \* Leave jumper lead in place.
  - \* Arrange for an electrician to check the earthing and bonding.
- (3 marks)

## Question 12

(a) and (b)

1. Locate and identify the fuse on the switchboard for the electric cylinder. (1 mark)
2. Switch off the circuit power supply and remove fuse carrier. (1 mark)
3. Attach Danger tag to fuse base. (1 mark)
4. Remove the isolator cover and test for isolation power at the supply side of the isolator using the prove-test-prove method. (2 marks)

Note: No.s 1 and 2 must occur first, No.s 3 and 4 can be in any order.

- (c)
- Disconnect wiring from thermostat and element. (1 mark)
  - Remove the wiring between the cylinder and the load side of the isolating switch. (1 mark)
- (d) \*
- Ensure the cover is securely replaced on the isolator (1 mark)
  - Replace Danger tag with Out of Service tag. (1 mark)
  - Advise the supervisor that the work is completed and the electric cylinder is now safe to remove. (1 mark)

### Section 3 – Gasfitters and Plumber/Gasfitters Only

#### Question 13

- \* 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 $\Omega$ . (1 mark)

#### Alternatively

- \* With all control switches on: (1 mark)
- Test with a 250V insulation resistance tester from the appliance framework to phase and neutral (3 marks)
- The result must not be less than 1 M $\Omega$ . (1 mark)

### Question 14

(a) and (b)

1. Locate and identify the fuse on the switchboard for the appliance. (1 mark)
2. Switch off the circuit power supply 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)

Note: No.s 1 and 2 must occur first, No.s 3 and 4 can be in any order.

- (c) Disconnect flexible cord from the permanent connection unit and remove appliance. (1 mark)
- (d) \*
- Ensure the permanent connection unit is securely fixed with no exposed live parts. (1 mark)
  - \* Replace danger tag with an out of service tag. (1 mark)
- (e) \*
- Go through the isolation procedure as in (a) above. (1 mark)
  - \* Test for isolation using the prove test prove method as per (b) above. (1 mark)

### Question 15

- (a) \* To ensure that all exposed metal is at earth potential.  
\* Maintains zero volts between all services which reduces the risk of electric shock or fire. (3 marks)
- (b) • The concrete and steel structure is in contact with the general earth mass.  
• The concrete and steel structure is conductive. (2 marks)

## Question 16

- (a) (i) **Direct contact**  
means contact, by any person or animal, with live parts, including contact by any thing being carried or worn by that person or animal  
ER 2  
(1 mark)
- (ii) **Isolated**  
in relation to fittings or electrical appliances, means that the fittings or appliances are deliberately disconnected from any source of electricity  
ER 2  
(1 mark)
- (iii) **MEN system** means a system of supply of electricity in which the neutral is connected to the earth—  
(a) at the source of supply; and  
(b) at points on the supply system; and  
(c) at every electrical installation connected to that system  
ER 2  
(3 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.  
ER 49(7)  
(3 marks)
- (c) 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)