



Candidate Code No.	
For Board Use Only	
Result	Result
Date	Date
Int	Int

ELECTRICAL WORKERS REGISTRATION BOARD

ELECTRICAL SERVICE TECHNICIAN “B” EXAMINATION

25 September 2004

QUESTION AND ANSWER BOOKLET

Time Allowed: Two Hours

INSTRUCTIONS – READ CAREFULLY

You have 10 minutes to read this paper but do not start writing until you are told to do so by the supervisor.

Write your Candidate Code Number in the box provided above. Your name must NOT appear anywhere in this paper.

Answer all questions.

The pass mark for this examination is 60 marks.

Use a pen for written answers. **Do not** use pencils or red pens.

Drawing instruments and pencils may be used when diagrams are required. Marks are allocated on the basis of correctness.

Do not use correcting fluid or correcting tape.

Non-programmable calculators may be used.

It is recommended that the reference source for your answers be included in the space provided if a question can be answered from the Act, Regulations, Standard or Code of Practice. However, just stating a reference only will earn no marks.

For calculation questions all workings, including formulae, must be shown to gain full marks.

Warning – You could get 0 marks for any question, or part of a question, if you show anything hazardous or dangerous in your answer.

You will need to use the following documents in this examination:

The Electricity Act 1992 and amendments
 The Electricity Regulations 1997 and the 1999 and 2002 Amendments or
 The Electricity Regulations Compilation 2003
 AS 1939 supplement 1 – 1990; AS/NZS 3000:2000 (including amendments 1 and 2); NZS 3019 (Int):2002; AS/NZS 3760:2001 or ; AS/NZS 3760:2003

ECP 34 and ECP 54

PLEASE HAND THIS PAPER TO THE SUPERVISOR BEFORE LEAVING THE ROOM
(turn over)

Question 1

- (a) Complete the table below by entering the single-phase electric motor type that would best suit each of the following applications: (2 marks)

Application	Motor Type
A desk fan	
A vacuum cleaner	
A saw bench	
A concrete mixer	

- (b) List **TWO** factors that affect the voltage drop in a two core flexible cord. (2 marks)

(1) _____

(2) _____

- (c) An HRC fuse that protects a subcircuit supplying a fixed wired electrical appliance rated at 2000W at 230V has blown.

- (i) Calculate the current rating of the appliance. (1 mark)

- (ii) State the minimum size HRC fuse that should be used. (1 mark)

(turn over)

Question 1 continued

- (d) Refer to the Electricity Regulations and calculate the minimum voltage permitted at the terminals of a hot water cylinder, if the supply voltage is 230 V. (2 marks)

Ref:

- (e) A three phase electric motor with a flexible cord and plug attached is to be tested before being returned to service. (2 marks)

- (i) State the minimum acceptable value for the insulation resistance between the windings of the motor _____
- (ii) State the maximum acceptable value for the resistance of the protective earthing conductor of the motor _____

(turn over)

Question 2

- (a) Explain why an ammeter must never be connected in parallel with a load. (2 marks)

- (b) Briefly explain the operation principles of an energy controller (Simmerstat) when controlling a heating load. (2 marks)

- (c) A trainee may assist in prescribed electrical work subject to supervision. Briefly state the requirements of the Electricity Regulations for **ONE** category of person who can provide this supervision. (2 marks)

Ref:

(turn over)

Question 2 continued

(d) Refer to the Electricity Regulations 1997, and state what is meant by each of the following terms.

(i) Earthed (1 mark)

(ii) Isolated (1 mark)

Ref:

(e) A three-heat switch controls two heating elements.

(i) When the **medium** position is selected, it will connect _____ the supply

(ii) When the **low** position is selected, it will connect _____ the supply

(2 marks)

(turn over)

Question 3

- (a) The New Zealand Multiple Earth Neutral system of single/three phase standard low voltage distribution requires the use of four conductors. List the standard nominal voltages that exist between each of the four conductors, and between each conductor and earth.

(4 marks)

- (b) State **TWO** reasons why a neutral conductor is required in the cable supplying a three-phase final subcircuit when it has heating loads that draw different values of current on each of the phases.

(4 marks)

(1)

(2)

(turn over)

Question 3 continued

- (c) What is the main difference between an MEN switchboard and a distribution switchboard?

(1 mark)

- (d) What type of switchboard is the first switchboard (closest to the point of supply) in an MEN electrical installation?

(1 mark)

(turn over)

Question 4

A three-phase fixed-wired induction motor running an industrial refrigeration plant requires new bearings. The motor is controlled by wall mounted isolating switch and is supplied by HRC fuses mounted on a switchboard. The isolating switch has a broken operating handle and cannot be used.

You have been requested to:

- Remove the three-phase motor, by disconnecting the cable at the motor
- Replace the isolating switch.

You do not need to contact the Supervisor before starting the work or after finishing.

Warning: If any part of your answer is dangerous or hazardous, you will get no marks for this question.

- (a) Describe how you would safely isolate the motor isolating switch and motor. (3 marks)

- (b) State how you would ensure that the isolator and motor is safely isolated. (2 marks)

(turn over)

Question 4 continued

(c) Describe the work you have been requested to do.

(2 marks)

(d) List the steps necessary to leave the site safe.

(3 marks)

(turn over)

Question 5

(a) According to the Electricity Act, every person shall on payment of the prescribed fee (if any), be entitled to be registered as an electrical service technician, if the person satisfies the Board that **FOUR** requirements have been met. State **THREE** of these requirements.

(3 marks)

(1) _____

(2) _____

(3) _____

Ref:

(b) The Electricity Act requires that a registered person who works for payment of reward must hold an additional type of licence.

(i) What is the name of the licence? (1 mark)

Ref:

(ii) On what date in any year does the licence expire? (1 mark)

Ref:

(iii) To whom must application be made for the licence? (1 mark)

Ref:

(turn over)

Question 5 continued

(c) Refer to the Electricity Regulations and answer the following:

(i) No person shall assist to carry out prescribed electrical work for the first time unless that person has satisfactorily completed safety tuition in **FOUR** specific subjects. What are those subjects?
(2 marks)

(1) _____

(2) _____

(3) _____

(4) _____

Ref:

(ii) At what intervals must a person complete the tuition in the subjects in (c)(i).
(2 marks)

Ref:

(turn over)

Question 7

(a) Electrical equipment designed for use in damp situations has an IP rating. An **IP rating** consists of the initials IP followed by two numbers. Refer to AS1939 or AS/NZS 3000 and answer the following:

(i) What is an IP rating? (2 marks)

Ref:

(ii) Explain what the first number after the letters IP indicates. (2 marks)

Ref:

(iii) What does the second number after the letters indicates. (2 marks)

Ref:

(b) Describe the level of protection offered by fittings rated at **IP56**. (2 marks)

5

6

Ref:

(turn over)

Question 7 continued

- (c) You have been requested to replace a 230V heated towel rail and adjacent control switch in a domestic bathroom. The towel rail and switch are in Zone 2 but neither have markings on them.

The replacement towel rail and adjacent control switch can be installed in Zone 2, but both must have the required degree of protection.

Refer to AS/NZS 3000 and state:

- (i) The minimum IP rating of the heated towel rail. (1 mark)

- (ii) The minimum IP rating of the control switch. (1 mark)

Ref:

(turn over)

Question 8

(a) What is meant by the term **current rating** of a fuse? (2 marks)

(b) What would be the overall effect on a final sub-circuit when the protection device operates and the circuit is protected by:-

(i) An under-rated fuse? (1 mark)

(ii) An over-rated fuse? (1 mark)

(iii) A phase failure relay? (1 mark)

(iv) A phase reversal relay? (1 mark)

(turn over)

Question 8 continued

- (c) State the **TWO** reasons explaining how HRC motor-rated fuse links provide backup protection for the thermal overloads in a DOL starter supplying a three-phase electric motor in the event of a short-circuit.

(2 marks)

(1) _____

(2) _____

- (d) State **TWO** reasons why it is important to thread the fuse wire from terminal to terminal through the tortuous path in the fuse carrier, when reloading a rewirable fuse.

(2 marks)

(1) _____

(2) _____

(turn over)

Question 9

State **TWO** likely causes for each of the following reported faults?

- (a) A 3-phase motor hums noisily but fails to rotate when started. (2 marks)

(1) _____

(2) _____

- (b) A lightly loaded a 3-phase motor begins to run noisily and then starts to overheat. (2 marks)

(1) _____

(2) _____

- (c) A direct on line (DOL) motor starter makes an excessive humming noise whenever the contactor is electrically engaged. (2 marks)

(1) _____

(2) _____

(turn over)

Question 9 continued

- (d) When a start button is pushed on a direct on line starter the contactor closes, but as soon as the start button is released again the contactor drops out of circuit.

(2 marks)

(1) _____

(2) _____

- (e) A single-phase capacitor start motor hums and fails to rotate on the bench when the supply is connected, yet it attains full load speed when the rotor is assisted by hand spinning.

(2 marks)

(1) _____

(2) _____

(turn over)

Question 10

A 20A circuit consists of two socket outlets and is protected by a RCD and a MCB.

The MCB tripped out. The supply was switched off and the MCB reset. When supply was restored to the circuit, the MCB tripped out again.

You have been requested by the Supervisor to locate the cause of the fault and, if possible make repairs. You have established from the nameplate data on each appliance that the combined load current did not overload the fuse.

You do not need to contact the Supervisor before starting the work or after finishing.

Warning: If any part of your answer is dangerous or hazardous, you will get no marks for this question.

(a) Describe how you would safely isolate the circuit.

(3 marks)

(b) Describe how you would ensure that the circuit is safely isolated.

(2 marks)

(turn over)

Question 10 continued

(c) What tests would you make to establish where the fault is.

(4 marks)

(d) Describe the action you would take once you have located the fault.

(1 mark)

For Candidate's Use

In the box, write the number of **EXTRA** sheets you have used. Write **NIL** if you have not used any

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Questions Answered	Marks	
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
TOTAL		