



<b>Candidate Code No.</b>	
<b>For Board Use Only</b>	
Result	Result
Date	Date
Int	Int

**ELECTRICAL WORKERS REGISTRATION BOARD**  
**ELECTRICAL SERVICE TECHNICIAN “B” EXAMINATION**

**14 May 2005**

**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 may need to use the following documents in this examination:**

- The Electricity Act 1992 and amendments
- The Electricity Regulations 1997 and the Electricity Amendment Regulations 1999, Electricity Amendment Regulations 2002 and the Electricity Amendment Regulations 2003; or  
The Electricity Regulations Compilation 2003 and the Electricity Amendment Regulations 2003; or  
The Integrated Electricity Regulations 1997
- AS 1939 supplement 1 – 1990; AS/NZS 3000:2000 (including amendments 1, 2, 3 and A); NZS 3019 (Int):2002 or NZS 3019:2004; 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) In the following statement write the appropriate words or figures that would correctly complete the statement.

When supplied at a constant voltage any decrease in the electrical resistance of any appliance will result in an increase in \_\_\_\_\_

\_\_\_\_\_ and \_\_\_\_\_

(2 marks)

- (b) Refer to the Electricity Regulations 1997 and state what is meant by the term **hazardous area**?

(2 marks)

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Ref: .....

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

(1) \_\_\_\_\_

(2) \_\_\_\_\_

- (d) In the following statement, write the appropriate words or figures that would correctly complete the statement.

The nominal voltage existing between a neutral conductor and earth in normal circumstances should ideally be \_\_\_\_\_

(2 marks)

**(turn over)**

**Question 1 continued**

- (e) Refer to the Electricity Regulations and state what is meant by the term **electrically safe?**

(2 marks)

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Ref .....

**(turn over)**

## Question 2

- (a) Explain how the direction of rotation can be reversed for a three phase squirrel cage induction motor

(2 marks)

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- (b) A three-phase induction motor's motor hums on starting but fails to rotate. List **TWO** possible causes for this fault.

(2 marks)

(1) \_\_\_\_\_

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(2) \_\_\_\_\_

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- (c) An ohmmeter is to be used to measure the resistance of a plug-in heater designed for use on 230V a.c. supply. When correctly connected to the heater's flexible cord plug-top the ohmmeter gives a reading of 24 ohms.

- (i) What value of current would the heater draw if it is plugged into a 240V a.c. supply?

(1 mark)

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- (ii) What power (watts) will the heater dissipate when it is supplied at 240V a.c.?

(1 mark)

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(turn over)

## Question 2 continued

- (d) Refer to the Electricity Regulations, what is meant by the term standard low voltage when applied to a single phase MEN system

(2 marks)

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- (e) List **TWO** circumstances in which 230V single phase metal clad electrical appliances must not be deliberately connected to earth.

(2 marks)

(1) \_\_\_\_\_

(2) \_\_\_\_\_

**(turn over)**

**Question 3**

- (a) Some three phase machines may be connected to the electricity supply by means of a four core flexible cord in which each conductor is identified by means of colour. Refer to AS/NZS 3000 and state the requirements that apply to the use of colours in such a cord?

(3 marks)

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Ref: .....

- (b) When selecting a flexible cord for fitting to a single phase, Class I, electrical appliance, it is necessary to consider its length and cross-sectional area - and the effect these will have on the heating and voltage drop in the cord.

List **FOUR** physical factors that may need to be considered in selecting the cord - and state what each affects.

(4 marks)

(1) \_\_\_\_\_  
\_\_\_\_\_

(2) \_\_\_\_\_  
\_\_\_\_\_

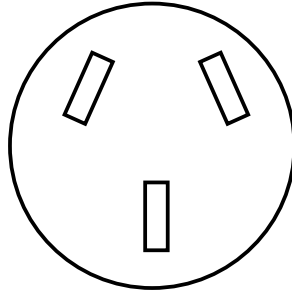
(3) \_\_\_\_\_  
\_\_\_\_\_

(4) \_\_\_\_\_  
\_\_\_\_\_

**(turn over)**

**Question 3 continued**

- (c) The figure below represents the face view of a 3 pin 10 amp socket outlet.  
Indicate on the figure the active (phase), neutral and earth slots of the socket.  
(3 marks)



**(turn over)**

**Question 4**

(a) (i) Sketch a circuit diagram of a single-phase capacitor start motor.

(2 marks)

(ii) Describe how the direction of rotation can be reversed for the motor in (a)(i) above

(2 marks)

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(b) Explain how the direction of rotation can be reversed for the following types of electric motors.

(i) Split-phase induction motor.

(2 marks)

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**(turn over)**

**Question 4 continued**

(ii) Universal (series) motor

(2 marks)

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(c) 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. State **TWO** likely causes of this fault?

(2 marks)

(1) \_\_\_\_\_

(2) \_\_\_\_\_

**(turn over)**

**Question 5**

- (a) (i) Refer to the Electricity Regulations and state the prescribed electrical work you will be entitled to carry out when you become registered as an Electrical Service Technician with a B limitation (“ESTB”).

(5 marks)

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Ref: .....

- (ii) State the limitation to the prescribed electrical work that you have stated in (a)(i) that the Electrical Workers Registration Board sets for Electrical Service Technician registration with a B limitation (“ESTB”).

(1 mark)

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**(turn over)**

**Question 5 continued**

(b) 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 (b)(i). (2 marks)

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\_\_\_\_\_

\_\_\_\_\_

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\_\_\_\_\_

Ref: .....

**(turn over)**

**Question 6**

(a) Circuit breakers are available in a number of different operational types. Describe the operating principle of the following types of circuit breakers, and state how each is caused to trip when an overload occurs.

(i) Thermal type. (2 marks)

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(ii) Magnetic type. (2 marks)

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(iii) A combined thermal/magnetic type. (3 marks)

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**(turn over)**

**Question 6 continued**

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

(2 marks)

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(c) A final sub-circuit is protected by an under-rated fuse. State **ONE** effect this could have on the operation of the circuit.

(1 mark)

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**(turn over)**

**Question 7**

- (a) State **FOUR** precautions which must be taken to ensure the safety of persons, animals and property after you have isolated, safety tagged and disconnected the conductors supplying a fixed-wired electrical appliance.

(4 marks)

(1) \_\_\_\_\_

\_\_\_\_\_

(2) \_\_\_\_\_

\_\_\_\_\_

(3) \_\_\_\_\_

\_\_\_\_\_

(4) \_\_\_\_\_

\_\_\_\_\_

- (b) What is the essential safety difference between switching an electrical appliance off and isolating an electrical appliance?

(2 marks)

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\_\_\_\_\_

\_\_\_\_\_

**(turn over)**

**Question 7 continued**

(c) Describe **FOUR** ways of safely isolating and ensuring the continued isolation of an electrical appliance.

(4 marks)

(1) \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

(2) \_\_\_\_\_

\_\_\_\_\_

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(3) \_\_\_\_\_

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(4) \_\_\_\_\_

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**(turn over)**

### Question 8

- (a) In addition to connecting the electrical supply conductors to three phase machines, it is also necessary to **securely** connect a protective earthing (earth continuity) conductor.

Explain the **purpose** of the protective earthing conductor, and why it is necessary to take such **care** in its termination. In your answer mention any minimum or maximum **test results** that apply.

(6 marks)

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- (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. (2 marks per answer)

(4 marks)

(1) 

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(turn over)

**Question 8 continued**

(2) \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
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\_\_\_\_\_  
\_\_\_\_\_

**(turn over)**

## Question 9

The Electricity Regulations require that when an electrical appliance has been repaired inspections and tests must be carried out in accordance with a specific Standard.

- (a) State the Standard number and prefix (1 mark)

\_\_\_\_\_

- (b) List the **THREE** inspections and tests that must be carried out in accordance with the Standard. (3 marks)

(1) \_\_\_\_\_

(2) \_\_\_\_\_

(3) \_\_\_\_\_

- (c) State the **TWO** tests required to be carried out with instruments and state the minimum or maximum test result that applies. (6 marks)

(1) Test \_\_\_\_\_  
Instrument \_\_\_\_\_  
Test result \_\_\_\_\_

(2) Test \_\_\_\_\_  
Instrument \_\_\_\_\_  
Test result \_\_\_\_\_

**(turn over)**

**Question 10**

- (a) State **THREE** 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.

(3 marks)

(1) \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

(2) \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

(3) \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

- (b) Briefly explain how a Residual Current Device (RCD) disconnects the supply from an electrical appliance when an earth leakage fault occurs.

(4 marks)

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**(turn over)**

**Question 10 continued**

(c) Why should an RCD be operationally tested?

(1 mark)

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(d) Refer to NZS 3019 and state:

(i) The maximum time in which an RCD used for personal protection must operate at its rated residual current.

(1 mark)

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Ref: .....

(ii) The maximum time in which an RCD used for personal protection must operate at five times its rated residual current.

(1 mark)

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Ref: .....

**For Candidate's Use**

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

**For Examiner's Use Only**

<b>Questions Answered</b>	<b>Marks</b>	
<b>1</b>		
<b>2</b>		
<b>3</b>		
<b>4</b>		
<b>5</b>		
<b>6</b>		
<b>7</b>		
<b>8</b>		
<b>9</b>		
<b>10</b>		
<b>TOTAL</b>		