



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

## **ELECTRICAL SERVICE TECHNICIAN "B" EXAMINATION**

**15 September 2007**

### **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 reprinted as at 19 August 2005.
- The Electricity Regulations 1997 reprinted as at 5 September 2005
- AS 60529 or AS 1939 supplement 1 – 1990; AS/NZS 3000:2000 (including amendments 1, 2, A and 3); 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) When replacing an HRC fuse which has blown, the replacement must have characteristics the same as the original. State **TWO** electrical characteristics to be checked for similarity.

(2 marks)

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

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

- (b) 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 AS/NZS 3000 or AS1939 - supplement 1 - 1990 or AS 60529 and answer the following:

- (i) What is an IP rating?

(1 mark)

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

Ref: .....

- (ii) What does the first number after the letters IP indicate?

(1 mark)

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

Ref: .....

- (c) State **TWO** types of protection devices that detect loss of one phase in a three-phase motor starter and disconnect the motor from the supply.

(2 marks)

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

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

**(turn over)**

## Question 1 continued

(d) Registered electrical service technicians must hold a licence to work for payment and reward.

(i) Name the type of licence that is required. (1 mark)

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(ii) For what period is this licence normally issued? (1 mark)

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(e) (i) Describe how the direction of rotation can be reversed in a single phase capacitor start motor above

(1 mark)

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(ii) Describe how the direction of rotation can be reversed in a Universal (series) motor

(1 mark)

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(f) No person shall assist to carry out prescribed electrical work unless that person has satisfactorily completed safety tuition in four specific subjects within the previous 24 months. Safe working practices and basic first aid are two of those subjects. Refer to the Electricity Regulations and state the **TWO** other subjects.

(2 marks)

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

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

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Ref: .....

**(turn over)**

**Question 1 continued**

(g) State **TWO** factors that affect the voltage drop in a three core flexible cord. (2 marks)

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

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

(h) A handheld electrical appliance used on a building or structure under construction must be used in conjunction with an appropriate safeguard. Refer to the Electricity Regulations and state **TWO** such safeguards. (2 marks)

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

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Ref: .....

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

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Ref: .....

(i) Refer to the Electricity Regulations and state what is meant by the term **standard low voltage** when applied to a multi-phase MEN system (2 marks)

\_\_\_\_\_

\_\_\_\_\_

Ref: .....

**(turn over)**

**Question 1 continued**

- (j) Refer to AS/NZS 3000 and state what is meant by the term "Class I electrical equipment"?

(2 marks)

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Ref: .....

**(turn over)**



### Question 3

- (a) You have disconnected the flexible cable from a three-phase fixed-wired appliance and have proved the cable isolated at the appliance isolator using the prove-test-prove method. State **FOUR** precautions which must be taken to ensure the safety of persons and prevent damage to property before leaving the work site.

(4 marks)

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

\_\_\_\_\_

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

\_\_\_\_\_

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

\_\_\_\_\_

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

\_\_\_\_\_

- (b) State the **TWO** reasons why the **prove test prove** method of testing for isolation is used.

(2 marks)

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

\_\_\_\_\_

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

\_\_\_\_\_

**(turn over)**

### Question 3 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 4

- (a) State the **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) When selecting a replacement cartridge for a blown HRC fuse, it is necessary to consider its Utilisation category (fusing factor).

- (i) What is meant by Utilisation category (fusing factor)?

(1 mark)

\_\_\_\_\_

- (ii) How does the Utilisation category (fusing factor) influence the fuse operation?

(2 marks)

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**(turn over)**

## Question 4 continued

- (iii) When selecting an HRC fuse link, why is it important to ensure that the correct rupturing capacity is chosen?

(2 marks)

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- (c) An HRC fuse has a minimum fusing current of 30A and has a utilisation category (fusing factor) of 1.5. Calculate the current rating of this fuse.

(2 marks)

**(turn over)**

## Question 5

- (a) You are using an ammeter to measure the current drawn by an electrical appliance. Describe what would happen if you connected the ammeter in parallel with that appliance.

(3 marks)

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- (b) You are using a voltmeter to measure the voltage on an electrical appliance. Describe what would happen if you connected the voltmeter in series with that appliance.

(3 marks)

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**(turn over)**

## Question 5 continued

(c) When connecting test instruments to measure voltage and current values of 230V electrical appliances it is important to observe set procedures to ensure personal safety. Briefly describe **FOUR** safety precautions relating to the test instruments that will promote personal safety. Assume the following:

- All necessary personal protective equipment is available.
- You are wearing no metallic objects.
- Set work procedures are available.
- All instruments are working correctly

(4 marks)

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

\_\_\_\_\_

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

\_\_\_\_\_

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

\_\_\_\_\_

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

\_\_\_\_\_

**(turn over)**

## Question 6

- (a) When selecting a flexible cord for fitting to a single phase 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** other physical factors that may need to be considered in selecting the cord.

(4 marks)

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- (b) (i) Explain why the voltage at the load end of a flexible cord extension set supplying current to an electrical appliance is less than that at the supply end of the cord?

(1 mark)

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- (ii) State **TWO** ways in which the effect in (b)(i) above can be reduced - assuming that the same appliance remains connected.

(2 marks)

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

\_\_\_\_\_

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

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**(turn over)**

**Question 6 continued**

- (c) All flexible cords are given a "current rating". What does "current rating" mean when applied to flexible cords?

(1 mark)

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- (d) A three-phase delta-connected motor is controlled by a DOL (direct-on-line) starter. It is connected to the electricity supply by means of a three-core, screened 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?

(2 marks)

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Ref: .....

**(turn over)**

## Question 7

- (a) Refer to the Electricity Regulations and state the Standard to which a plug-in Class I electrical appliance must be tested following completion of repairs? State the reference in your answer.

(1 mark)

\_\_\_\_\_

Ref: .....

- (b) Refer to the Standard required in (a) above and complete the following table. State in your answer whether an acceptable test result is a maximum or minimum value.

(4 marks)

Test using test instruments	Type of instrument required	Acceptable test result

Ref: .....

- (c) Refer to the Standard required in (a) above and state:

- (i) **TWO** specific checks that should be carried out on the flexible cord of the appliance.

(2 marks)

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

\_\_\_\_\_

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

\_\_\_\_\_

**(turn over)**

## Question 7 continued

- (ii) **THREE** specific checks that should be carried out on the appliance itself (not the cord or plug).

(3 marks)

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

\_\_\_\_\_

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

\_\_\_\_\_

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

\_\_\_\_\_

**(turn over)**

## Question 8

(a) A three-phase induction motor is controlled by a DOL starter with a 230V control circuit. Sketch a labelled schematic diagram of the control circuit that includes the following components.

- a fuse
- stop button
- start button
- a remote stop/start station.
- hold in contact (maintaining contact)
- thermal overload relay contact
- 230V coil

Note: You do not need to draw the main contacts or the motor.

(6 marks)

**(turn over)**

## Question 8 continued

- (b) You are required to investigate a fault on a three-phase motor and motor circuit. You are told that the motor and motor circuit is protected by HRC fuses and thermal overloads. However, the motor is a type that is sensitive to increases in temperature above the normal operating temperature and additional protection has been installed to counter this.

(i) State the type of additional protection that is installed?

(1 mark)

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(ii) State where this additional protection would be installed.

(1 mark)

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- (c) A three-phase induction motor overheats while running, but the current in all three phases is the same as the nameplate rating. List **TWO** possible causes for this fault.

(2 marks)

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

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

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**(turn over)**



## Question 9 continued

(b) Before you reconnect the machine

Briefly describe the sequence of actions you should take to ensure your own safety.

(2 marks)

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(c) After you reconnect the machine

Describe the additional checks and/or tests you will make.

(3 marks)

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**For Candidate's Use**

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

<b>For Examiner's Use Only</b>		
<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>TOTAL</b>		