



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

ELECTRICAL SERVICE TECHNICIAN "B" EXAMINATION

24 November 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 will need to use some of 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) An applicant for a practising licence – who has previously held a licence – must have attended a refresher course. Refer to the Electricity Regulations and state **TWO** of the subjects that must be covered in a refresher course:

(2 marks)

(1) _____

(2) _____

Ref:

- (b) A handheld electrical appliance used by a person who is partially immersed in a conductive substance must be used in conjunction with an appropriate safeguard. Refer to the Electricity Regulations and state **TWO** such safeguards.

(2 marks)

(1) _____

(2) _____

Ref:

- (c) Calculate the current drawn by a 230/240 volt electric soldering iron rated at 92 watts when operating at 240 volts.

(2 marks)

(turn over)

Question 1 continued

- (d) When testing for isolation, it is found that there are live conductors at the terminals of a fixed-wired electrical appliance after the isolating switch is turned to the off position. State **TWO** circumstances that may cause such a situation to occur.

(2 marks)

(1) _____

(2) _____

- (e) Repaired electrical appliances should be tested in accordance with AS/NZS 3760. Refer to that Standard and state the **TWO** tests required to be carried out with instruments and state the minimum or maximum test result that applies.

(2 marks)

(i) Test _____

Test result _____

Ref:

(ii) Test _____

Test result _____

Ref:

- (f) A thermal overload protecting a three-phase motor has operated. What has the thermal overload detected that would cause it to operate?

(2 marks)

(turn over)

Question 1 continued

- (g) A thermistor overload protecting a three-phase motor has operated. What has the thermistor detected that would cause it to operate? (2 marks)

- (h) A fuse has blown on a switchboard circuit supplying a single plug-in appliance. The appliance has been disconnected and taken away to be tested for faults. When the main switch is turned on with the appliance still disconnected the fuse blows again.

- (i) What is the probable cause of the fault? (1 mark)

- (ii) What action should be taken to rectify it? (1 mark)

- (i) A single-phase split-phase motor hums and fails to rotate on the bench when the supply is connected. It reaches full load speed when the rotor is assisted by hand spinning. State **TWO** possible causes for this fault. (2 marks)

(1) _____

(2) _____

(turn over)

Question 1 continued

(j) For the New Zealand MEN system state:

- (i) The nominal voltage that should exist between a neutral conductor and earth

(1 mark)

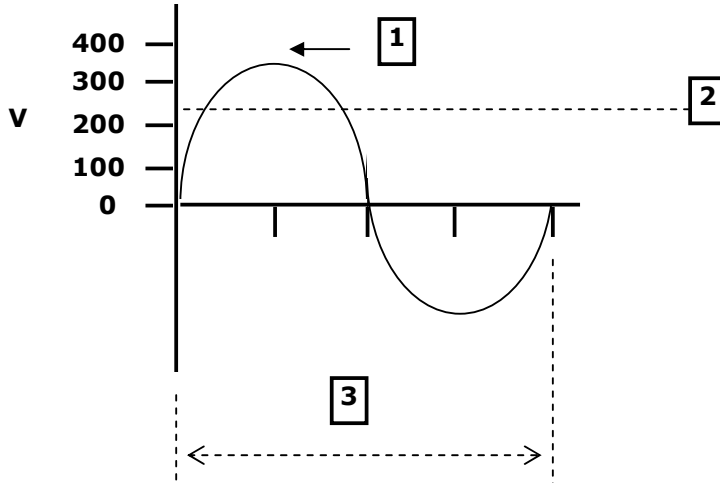
- (ii) The nominal voltage that should exist between any active conductor and the neutral conductor

(1 mark)

(turn over)

Question 2

(a) The following diagram shows a 230 V waveform.



(i) Is it an a.c. voltage or d.c. voltage waveform?

(1 mark)

(ii) Name the numbered items and state the value that applies to each item

(3 marks)

1. _____

2. _____

3. _____

(b) The New Zealand single phase 230V a.c. supply operates at a frequency of 50 Hz. Briefly describe the meaning of the term Hz.

(1 mark)

(turn over)

Question 2 continued

(c) It is necessary to have a reliable protective earthing conductor for a Class I electrical appliance.

(i) Briefly describe how a protective earthing conductor contributes to the electrical safety of a Class I electrical appliance.

(2 marks)

(ii) Briefly describe the actions you would take if the protective earthing conductor test on a Class I electrical appliance **you have repaired** is 15Ω .

(3 marks)

(turn over)

Question 3 continued

(b) State **TWO** likely causes of the fault

(2 marks)

(1) _____

(2) _____

(c) After you have repaired the fault and re-tested and reconnected the motor, what actions would you take to ensure that the planer is operationally safe?

(4 marks)

(turn over)

Question 4

(a) Electrical equipment designed for use in damp situations has an International Protection Classification (IP rating). An IP rating consists of the initials IP followed by two numbers. Refer to AS1939, AS 60529 or AS/NZS 3000 and answer the following:

(i) State what is meant by an International Protection Classification (IP rating)

(2 marks)

Ref:

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

(2 marks)

Ref:

(iii) Explain what the second number after the letters IP indicates.

(2 marks)

Ref:

(b) Refer to AS1939 or AS 60529 and describe the level of protection offered by fittings rated at **IP34**.

(2 marks)

Ref:

(turn over)

Question 4 continued

(c) You have been requested to replace a faulty motor and control switch for a swimming pool pump. Neither the motor or control switch has any visible markings as the markings have been painted over.

- The motor is in Zone 1 of the swimming pool.
- The control switch is in Zone 2 of the swimming pool.

Refer to AS/NZS 3000 and state:

(i) The minimum IP rating requirement for the replacement pump motor. (1 mark)

Ref:

(ii) The minimum IP rating requirement for the replacement control switch. (1 mark)

Ref:

(turn over)

Question 5

An HRC fuse protects a 20A circuit consisting of two plug sockets supplying various electrical appliances in an office. The fuse has blown. When the fuse is replaced, it blows again when the supply is restored to the circuit. The fuse is not faulty and correctly rated for the circuit.

(a) State the **THREE** possible causes of the HRC fuse blowing the second time. (3 marks)

(1) _____

(2) _____

(3) _____

(b) For each of the possible causes you have written in (a), state:

- What action you would take to establish that this is the cause.
- The remedial action you would take or recommend to the manager of the office.

(7 marks)

(i) Possible cause No. 1

Action taken to establish that this is the cause.

Remedial action taken or recommended

(turn over)

Question 5 continued

(ii) Possible cause No. 2

Action taken to establish that this is the cause.

Remedial action taken or recommended

(iii) Possible cause No. 3

Action taken to establish that this is the cause.

Remedial action taken or recommended

(turn over)

Question 6

- (a) A three-phase induction motor is controlled by a DOL starter with a 230V control circuit. Draw and label a diagram of the control circuit that includes the following components.
- a fuse
 - stop button
 - start button
 - hold in contact (maintaining contact)
 - thermal overload relay contact
 - 230V coil

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

(4 marks)

(turn over)

Question 6 continued

(b) The figure in (ii) below represents the terminal block on an old three-phase induction motor. There are no markings on the terminal block to indicate which pair of terminals are the ends of a winding.

(i) Describe the procedure you would carry out to identify the winding terminals of the motor. Include in your description the type of instrument you would use.

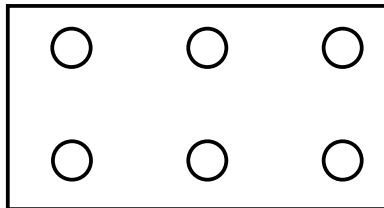
(2 marks)

(iii) On the terminal block below:

- Label the terminals,
- Draw the links,
- Draw the supply lines,

so the motor can be started direct-on-line in delta.

(2 marks)



(turn over)

Question 6 continued

- (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) _____

(2) _____

(turn over)

Question 7

- (a) 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)

- (b) State **TWO** ways in which the effect in (a) above can be reduced.

(2 marks)

(1) _____

(2) _____

- (c) All flexible cords are given a **current rating**. What does **current rating** mean?

(2 marks)

(turn over)

Question 7 continued

- (d) A 230V, single phase, three-core flexible cord supplying a Class I electrical appliance is required to be replaced. In the table below, state the colour coding acceptable in New Zealand and the polarity for the replacement cord.

(3 marks)

Existing cord conductor colours	Acceptable Colours in New Zealand	Polarity
Green		
Black		
Red		

- (e) A microgap switch is rated to switch a circuit at 10 amp 230V a.c. only. State **ONE** reason why this switch would not be suitable for use on a d.c. circuit of similar current and voltage.

(2 marks)

(turn over)

Question 8

- (a) You are connecting two multi-function test instruments to measure voltage and current values of a live 230V electrical appliance. When doing this work it is important to observe set procedures to ensure personal safety. Briefly describe **FOUR** important electrical precautions relating to the test instruments that which will promote personal safety.

- Note:
1. All the necessary safety equipment (overalls, rubber mats etc.) is available.
 2. Set procedures are available.
 3. All conductive items (e.g., rings) have been removed.

(4 marks)

(1) _____

(2) _____

(3) _____

(4) _____

(turn over)

Question 8 continued

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

(2 marks)

(1) _____

(2) _____

- (ii) Explain how the **prove test prove** procedure is carried out.

(3 marks)

- (c) Describe **ONE** method of ensuring the continued isolation of a fixed wired electrical appliance after you have attached a danger tag to the isolating switch.

(1 mark)

(turn over)

Question 9

(a) The test report for a plug-in Class I, 230V, 2000W commercial vacuum cleaner states the following:

- The resistance between the earth pin of the plug and the frame of the cleaner is 10.6 Ω .
- The insulation resistance test shows a phase to frame short circuit with the cleaner switch off.

The cleaner has not been repaired.

If the cleaner was plugged into a live socket outlet but not switched on:

- (i) Calculate the fault current flowing in the appliance. The resistance in the phase to frame short circuit is 2 Ω .

(2 marks)

- (ii) The circuit into which the cleaner is plugged is protected by a 16A HRC fuse with a utilisation category (fusing factor) of 1.5.

Calculate whether the fuse will operate (blow).

(2 marks)

(turn over)

Question 9 continued

(iii) Calculate the power dissipated in the faulty cleaner.

(2 marks)

(b) (i) A 230V, Class I, plug-in electrical appliance is controlled by a single pole switch. You are testing the appliance with an ohmmeter and find that the neutral is switched.

Describe the **THREE** situations that could cause the neutral to be switched instead of the phase in the appliance.

(3 marks)

(1) _____

(2) _____

(3) _____

(ii) State **ONE** unsafe effect on the operation of an electrical appliance a phase and neutral transposition could create.

(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

For Examiner's Use Only		
Questions Answered	Marks	
1		
2		
3		
4		
5		
6		
7		
8		
9		
TOTAL		