



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

ELECTRICAL SERVICE TECHNICIAN "B" EXAMINATION

19 September 2009

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 some of the following documents in this examination:

- The Electricity Act 1992 reprint dated 19 August 2005
- The Electricity Regulations 1997 reprint dated 2 September 2005
- AS 60529 **or** AS 1939 Supplement 1-1990
- AS/NZS 3000:2000 and Amendments 1, 2 and 3 **or** AS/NZS 3000:2007
- AS/NZS 3760:2003 and Amendment 1
- NZS 3019:2004 **or** AS/NZS 3019:2007
- ECP 34
- ECP 54

PLEASE HAND THIS PAPER TO THE SUPERVISOR BEFORE LEAVING THE ROOM

(turn over)

Question 1

- (a) Refer to the Electricity Regulations, and **briefly state the essential requirements** of the term "electrically safe".

(2 marks)

Ref:

- (b) Refer to the Electricity Regulations and list **TWO** situations where fittings or electrical appliances are deemed not to be electrically safe.

(2 marks)

(1) _____

(2) _____

Ref:

- (c) Electrical equipment designed for use in damp situations has an IP rating – an International Protection rating or Ingress protection rating. An IP rating consists of the initials IP followed by two numbers. Refer to AS1939; AS 60529 or AS/NZS 3000 and state what is meant by an IP rating?

(2 marks)

Ref:

(turn over)

Question 1 continued

- (d) An Electrical Service Technician intends to isolate a fixed-wired three-phase electric motor, but has withdrawn the wrong fuses for that motor on the factory switchboard.

State **TWO** dangerous conditions that could occur because the electrical service technician withdrew the wrong fuses.

(2 marks)

(1) _____

(2) _____

- (e) Which **TWO** of the following factors will **not** affect the voltage drop in a two core flexible cord?

- Insulation resistance
- Resistance
- Fusing factor
- Cross-sectional area

(2 marks)

(1) _____

(2) _____

(turn over)

Question 1 continued

(f) A switch controls two heating elements of the same resistance. The switch has three positions – “high”, “medium” and “low”.

(i) When the **high** position is selected:

(A) How many elements will be connected to the supply? (½ mark)

(B) How will the elements will be connected to the supply? (½ mark)

(ii) When the **low** position is selected:

(A) How many elements will be connected to the supply? (½ mark)

(B) How will the elements be connected to the supply? (½ mark)

(g) Refer to the Electricity Regulations and state the **TWO** practical steps an employee must take when carrying out work requiring personal protective equipment.

(2 marks)

(1) _____

(2) _____

Ref:

(turn over)

Question 1 continued

- (h) A fuse has blown on a switchboard circuit supplying a single phase plug-in appliance. The appliance has been disconnected and taken away to be tested for faults.

When the fuse is replaced and the main switch is turned on, the fuse blows again. What is the probable cause of the fault and what action should be taken to rectify it?

(2 marks)

- (i) Refer to AS1939, AS 60529 or AS/NZS 3000 and describe the level of protection offered by fittings rated at IP34.

(2 marks)

3

4

Ref:

(turn over)

Question 1 continued

- (j) The manager of a factory has asked you how often the Class I and Class II electrical appliances in the factory should be tested and inspected. Refer to AS/NZS 3760 state the inspection intervals for:

(2 marks)

Class I appliances _____

Class II appliances _____

Ref:

(turn over)

Question 2

Portable electrical appliances should be used with a safeguard such as an isolating transformer or RCD when used outdoors.

- (a) An isolating transformer is constructed with one socket outlet terminal on the secondary side. Two electrical appliances are plugged into this isolating transformer. One appliance has a "piggy-back" type plug and the other appliance is plugged into this.

Why does the use of two electrical appliances from this isolating transformer increase the possibility of electric shock under fault conditions?

(4 marks)

- (b) An electrical appliance is being used outdoors with an extension lead. State the main reason why you would plug a portable RCD into the socket outlet and plug the extension lead and appliance into that RCD.

(1 mark)

- (c) State **TWO** reasons why a Portable Residual Current Device (PRCD) is "voltage dependent". That is, if the electricity supply to the device fails, the device trips.

(2 marks)

(1) _____

(2) _____

(turn over)

Question 2 continued

(d) 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 the **THREE** types of safeguard that can be used.

(3 marks)

(1) _____

(2) _____

(3) _____

Ref:

(turn over)

Question 3

A three-phase, Class I, plug-in electrical appliance has been repaired. MIMS elements are incorporated in the appliance.

- (a) Refer to the Electricity Regulations and state the Standard to which the three-phase 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.

Note: An earth leakage tester **cannot** be used

(3 marks)

Test using test instruments	Type of instrument required	Acceptable test result
Protective earthing conductor test		
Insulation resistance test		

Ref:

(turn over)

Question 3 continued

(c) Refer to the Standard required in (a) above and state **TWO** specific visual checks (inspections) that should be carried out on the flexible cord of the appliance.

(2 marks)

(1) _____

(2) _____

Ref:

(d) Refer to the Standard required in (a) above and state **TWO** specific visual checks (inspections) that should be carried out on the appliance itself (not the cord or plug).

(2 marks)

(1) _____

(2) _____

Ref:

(e) Describe how you would carry out an insulation resistance test on the Class 1 appliance.

(1 mark)

(f) Describe how you would carry out a protective earthing conductor test on the Class 1 appliance.

(1 mark)

(turn over)

Question 4

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

(i) Capacitor start induction motor.

(1 mark)

(ii) Universal (series) motor

(1 mark)

(b) A small electric motor has a nameplate that reads:

Voltage	230
Phases	1
Horsepower	0.75
Speed	1425 r.p.m.

Calculate the current drawn by the motor.

(3 marks)

(turn over)

Question 4 continued

(c) (i) Sketch and label a circuit diagram of a single-phase split-phase motor.
(2 marks)

(ii) State **ONE** device that can be used in a single-phase capacitor start motor or split phase motor in place of a centrifugal switch?
(1 mark)

(d) A universal (series) motor is controlled by means of a reversing switch. State what would occur if attempts were made to reverse the motor while it was still running.
(2 marks)

(turn over)

Question 5

A three-phase fixed-wired electrical appliance is required to be repaired.

- (a) You are going to prove that the appliance is isolated using the prove-test-prove method. What does the prove-test-prove method of testing establish?

(2 marks)

(1) _____

(2) _____

- (b) The appliance is supplied via a flexible cable from a lockable isolating switch. The circuit supplying the appliance is protected by HRC fuses.

You have proved that the appliance is isolated using the prove-test-prove method.

Describe **FOUR** methods, any one of which will ensure the continued isolation of the electrical appliance.

(4 marks)

(1) _____

(2) _____

(3) _____

(4) _____

(turn over)

Question 5 continued

- (c) You have proved that the appliance is isolated and have ensured the continued isolation of the appliance.

The fixed-wired appliance is supplied via a flexible cable from the lockable isolating switch. You have disconnected the flexible cord from the appliance (that is, the flexible cord is still connected to the isolating switch).

State **FOUR** precautions which you would take to ensure the safety of persons and property after you have disconnected the appliance.

(4 marks)

(1) _____

(2) _____

(3) _____

(4) _____

(turn over)

Question 6

- (a) A single phase 230V Class I, plug-in electrical appliance is supplied via a flexible cord. State the **TWO** sets of colour coding, either of which can be used for the flexible cord. State the polarity for each colour.

Note: To gain marks for each set you must state the all the colours and polarity accurately.

(6 marks)

Set 1

Set 2

- (b) 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, neutral-screen flexible cord.

Refer to AS/NZS 3000 and state **ONE** set of colours for the cord conductors when the cord is terminated in the motor terminal block.

- Note:
1. To gain marks for this question you must state all the colours and polarity accurately.
 2. You must use only a set of colours that apply in New Zealand

(2 marks)

Ref:

(turn over)

Question 6 continued

- (c) If the phrase "it is the maximum current that it is designed to carry safely" is used in respect to a flexible cord, what characteristic is being described?
(1 mark)

- (d) 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)

(turn over)

Question 7

Note: Read the entire question before commencing.

A three-phase bakery oven comprising three single-phase 6 kW elements is faulty. You have safely isolated the oven

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

- (a) The manager has told you that two HRC fuses blew immediately after being replaced BUT one element in the oven still operates.

State **TWO** reasons why the oven operates on one element with two fuses blown.

(2 marks)

(1) _____

(2) _____

- (b) The manager has told you that two HRC fuses blew immediately after being replaced BUT one element in the oven still operates. You have found that the oven circuit to the isolator; the isolator; the contactor and the HRC fuses are not faulty. The fuses are correctly rated.

- (i) Given that one element and the control circuit operates, what are the **THREE** possible locations of the faults:

(1½ marks)

(1) _____

(2) _____

(3) _____

(turn over)

Question 7 continued

- (ii) What type of instrument test would you use to find the fault at any of the locations you have stated in (b)(i). State the type of instrument used and any test voltage that may be applicable.

(1½ marks)

- (iii) Describe how you would test at each of the locations you have stated in (b)(i). Include the expected test results assuming that each part is faulty.

(5 marks)

(1) _____

(2) _____

(3) _____

(turn over)

Question 8 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 it is operationally safe?

(4 marks)

(turn over)

Question 9

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

- (i) Name the organisation that approved the form for an application for a practising licence.

(1 mark)

Ref:

- (ii) State the circumstances under which the holder of a practising licence must carry that licence.

(1 mark)

Ref:

(b) 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:

- (i) The period before the date of applying for a licence in which an applicant must have attended the refresher course.

(1 mark)

Ref:

- (ii) **FOUR** of the subjects that must be covered in refresher course:
(4 marks)

(1) _____

(2) _____

(3) _____

(4) _____

Ref:

(turn over)

Question 9 continued

- (c) The Electricity Act lists **SEVEN** classes of person who may do, or assist in doing prescribed electrical work. Trainees are one class of person. Refer the Electricity Act and list **THREE** other of classes of person.

(3 marks)

(1) _____

(2) _____

(3) _____

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